SEQUENCE LISTING

<110> Chappell, Joseph
      Noel, Joseph P.
      Starks, Courtney M.
      Manna, Kathleen R.

<120> SYNTHASES

<130> 07678-025001

<140> 09/398,395
<141> 1999-09-17

<150> 60/100,993
<151> 1998-09-18

<150> 60/130,628
<151> 1999-04-22

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Glu Glu Glu Ile Val Arg Pro Val Ala Asp Phe Ser Pro Ser Leu Trp
 10              15              20              25


ggt gat cag ttc ctt tca ttc tcc att aaa aat cag gtt gca gaa aag      147
Gly Asp Gln Phe Leu Ser Phe Ser Ile Lys Asn Gln Val Ala Glu Lys
             30              35              40


tat gct caa gag att gaa gca ttg aag gaa caa acg agg aat atg ctg      195
Tyr Ala Gln Glu Ile Glu Ala Leu Lys Glu Gln Thr Arg Asn Met Leu
             45              50              55


tta gca act gga atg aaa ttg gct gat aca ctg aat ttg ata gac act      243
Leu Ala Thr Gly Met Lys Leu Ala Asp Thr Leu Asn Leu Ile Asp Thr
         60              65              70
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att gaa cgc ctt ggc ata tcc tac cac ttt gag aaa gaa att gat gat        291
Ile Glu Arg Leu Gly Ile Ser Tyr His Phe Glu Lys Glu Ile Asp Asp
    75                  80                  85

att ttg gat cag att tac aac caa aac tca aac tgc aac gat ttg tgc        339
Ile Leu Asp Gln Ile Tyr Asn Gln Asn Ser Asn Cys Asn Asp Leu Cys
90                  95                 100                 105

act tct gca ctt caa ttt cga ttg ctc agg caa cat ggt ttc aac atc        387
Thr Ser Ala Leu Gln Phe Arg Leu Leu Arg Gln His Gly Phe Asn Ile
                110                 115                 120

tct cct gaa att ttc agc aaa ttc caa gac gaa aat ggc aaa ttc aag        435
Ser Pro Glu Ile Phe Ser Lys Phe Gln Asp Glu Asn Gly Lys Phe Lys
                125                 130                 135

gaa tct ctt gct agt gat gtc tta gga tta ttg aac ttg tat gaa gct        483
Glu Ser Leu Ala Ser Asp Val Leu Gly Leu Leu Asn Leu Tyr Glu Ala
        140                 145                 150

tca cat gta agg act cat gct gac gat atc tta gaa gac gca ctt gct        531
Ser His Val Arg Thr His Ala Asp Asp Ile Leu Glu Asp Ala Leu Ala
    155                 160                 165

ttc tcc act atc cat ctt gaa tct gca gct cca cat ttg aaa tct cca        579
Phe Ser Thr Ile His Leu Glu Ser Ala Ala Pro His Leu Lys Ser Pro
170                 175                 180                 185

ctt agg gag caa gtg aca cat gcc ctt gag caa tgt ttg cac aag ggt        627
Leu Arg Glu Gln Val Thr His Ala Leu Glu Gln Cys Leu His Lys Gly
                190                 195                 200

gtt cct aga gtc gag acc cga ttc ttc atc tca tca atc tat gac aag        675
Val Pro Arg Val Glu Thr Arg Phe Phe Ile Ser Ser Ile Tyr Asp Lys
                205                 210                 215

gaa caa tcg aag aat aat gtg tta ctt cga ttt gcc aaa ttg gat ttc        723
Glu Gln Ser Lys Asn Asn Val Leu Leu Arg Phe Ala Lys Leu Asp Phe
        220                 225                 230

aac ttg ctc cag atg ttg cac aaa caa gaa ctt gct caa gta tca agg        771
Asn Leu Leu Gln Met Leu His Lys Gln Glu Leu Ala Gln Val Ser Arg
    235                 240                 245

tgg tgg aaa gat ttg gat ttt gta aca aca ctt cca tat gct aga gat        819
Trp Trp Lys Asp Leu Asp Phe Val Thr Thr Leu Pro Tyr Ala Arg Asp
250                 255                 260                 265

cga gta gtt gaa tgc tac ttt tgg gca tta gga gtt tat ttt gag cct        867
Arg Val Val Glu Cys Tyr Phe Trp Ala Leu Gly Val Tyr Phe Glu Pro
                270                 275                 280

caa tac tct caa gct cgc gtc atg ctc gtt aag acc ata tca atg att        915
Gln Tyr Ser Gln Ala Arg Val Met Leu Val Lys Thr Ile Ser Met Ile
                285                 290                 295
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tcg att gtc gat gac acc ttt gat gct tac ggt aca gtt aaa gaa ctt       963
Ser Ile Val Asp Asp Thr Phe Asp Ala Tyr Gly Thr Val Lys Glu Leu
        300             305             310

gag gca tac aca gat gcc ata caa aga tgg gat atc aac gaa att gat      1011
Glu Ala Tyr Thr Asp Ala Ile Gln Arg Trp Asp Ile Asn Glu Ile Asp
    315             320             325

cgg ctt cct gat tac atg aaa atc agt tac aaa gct att cta gat ctc      1059
Arg Leu Pro Asp Tyr Met Lys Ile Ser Tyr Lys Ala Ile Leu Asp Leu
330             335             340             345

tac aag gat tat gaa aag gaa ttg tct agt gcc gga aga tct cat att      1107
Tyr Lys Asp Tyr Glu Lys Glu Leu Ser Ser Ala Gly Arg Ser His Ile
            350             355             360

gtc tgc cat gca ata gaa aga atg aaa gaa gta gta aga aat tat aat      1155
Val Cys His Ala Ile Glu Arg Met Lys Glu Val Val Arg Asn Tyr Asn
            365             370             375

gtc gag tca aca tgg ttt att gaa gga tat acg cca cct gtt tct gaa      1203
Val Glu Ser Thr Trp Phe Ile Glu Gly Tyr Thr Pro Pro Val Ser Glu
        380             385             390

tac cta agc aat gca cta gca act acc aca tat tac tac ctc gcg aca      1251
Tyr Leu Ser Asn Ala Leu Ala Thr Thr Thr Tyr Tyr Tyr Leu Ala Thr
    395             400             405

aca tcg tat ttg ggc atg aag tct gcc acg gag caa gat ttt gag tgg      1299
Thr Ser Tyr Leu Gly Met Lys Ser Ala Thr Glu Gln Asp Phe Glu Trp
410             415             420             425

ttg tca aag aat cca aaa att ctt gaa gct agt gta att ata tgt cga      1347
Leu Ser Lys Asn Pro Lys Ile Leu Glu Ala Ser Val Ile Ile Cys Arg
            430             435             440

gtt atc gat gac aca gcc acg tac gag gtt gag aaa agc agg gga caa      1395
Val Ile Asp Asp Thr Ala Thr Tyr Glu Val Glu Lys Ser Arg Gly Gln
            445             450             455

att gca act gga att gag tgc tgc atg aga gat tat ggt ata tca aca      1443
Ile Ala Thr Gly Ile Glu Cys Cys Met Arg Asp Tyr Gly Ile Ser Thr
    460             465             470

aaa gag gca atg gct aaa ttt caa aat atg gct gag aca gca tgg aaa      1491
Lys Glu Ala Met Ala Lys Phe Gln Asn Met Ala Glu Thr Ala Trp Lys
    475             480             485

gat att aat gaa gga ctt ctt agg ccc act ccc gtc tct aca gaa ttt      1539
Asp Ile Asn Glu Gly Leu Leu Arg Pro Thr Pro Val Ser Thr Glu Phe
490             495             500             505

tta act cct att ctc aat ctt gct cgt att gtt gag gtt aca tat ata      1587
Leu Thr Pro Ile Leu Asn Leu Ala Arg Ile Val Glu Val Thr Tyr Ile
            510             515             520

cac aat cta gat gga tac act cat ccg gag aaa gtc tta aaa cct cac      1635
His Asn Leu Asp Gly Tyr Thr His Pro Glu Lys Val Leu Lys Pro His
```

His Asn Leu Asp Gly Tyr Thr His Pro Glu Lys Val Leu Lys Pro His
         525   530   535

att att aac cta ctt gtg gac tcc atc aaa att tga   1671
Ile Ile Asn Leu Leu Val Asp Ser Ile Lys Ile
         540   545

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            20   25   30
Ser Ile Lys Asn Gln Val Ala Glu Lys Tyr Ala Gln Glu Ile Glu Ala
        35   40   45
Leu Lys Glu Gln Thr Arg Asn Met Leu Leu Ala Thr Gly Met Lys Leu
    50   55   60
Ala Asp Thr Leu Asn Leu Ile Asp Thr Ile Glu Arg Leu Gly Ile Ser
65   70   75   80
Tyr His Phe Glu Lys Glu Ile Asp Asp Ile Leu Asp Gln Ile Tyr Asn
                85   90   95
Gln Asn Ser Asn Cys Asn Asp Leu Cys Thr Ser Ala Leu Gln Phe Arg
            100   105   110
Leu Leu Arg Gln His Gly Phe Asn Ile Ser Pro Glu Ile Phe Ser Lys
        115   120   125
Phe Gln Asp Glu Asn Gly Lys Phe Lys Glu Ser Leu Ala Ser Asp Val
    130   135   140
Leu Gly Leu Leu Asn Leu Tyr Glu Ala Ser His Val Arg Thr His Ala
145   150   155   160
Asp Asp Ile Leu Glu Asp Ala Leu Ala Phe Ser Thr Ile His Leu Glu
                165   170   175
Ser Ala Ala Pro His Leu Lys Ser Pro Leu Arg Glu Gln Val Thr His
            180   185   190
Ala Leu Glu Gln Cys Leu His Lys Gly Val Pro Arg Val Glu Thr Arg
        195   200   205
Phe Phe Ile Ser Ser Ile Tyr Asp Lys Glu Gln Ser Lys Asn Asn Val
    210   215   220
Leu Leu Arg Phe Ala Lys Leu Asp Phe Asn Leu Leu Gln Met Leu His
225   230   235   240
Lys Gln Glu Leu Ala Gln Val Ser Arg Trp Trp Lys Asp Leu Asp Phe
                245   250   255
Val Thr Thr Leu Pro Tyr Ala Arg Asp Arg Val Val Glu Cys Tyr Phe
            260   265   270
Trp Ala Leu Gly Val Tyr Phe Glu Pro Gln Tyr Ser Gln Ala Arg Val
        275   280   285
Met Leu Val Lys Thr Ile Ser Met Ile Ser Ile Val Asp Asp Thr Phe
    290   295   300
Asp Ala Tyr Gly Thr Val Lys Glu Leu Glu Ala Tyr Thr Asp Ala Ile
305   310   315   320
Gln Arg Trp Asp Ile Asn Glu Ile Asp Arg Leu Pro Asp Tyr Met Lys
                325   330   335
Ile Ser Tyr Lys Ala Ile Leu Asp Leu Tyr Lys Asp Tyr Glu Lys Glu

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               340                     345                     350
Leu Ser Ser Ala Gly Arg Ser His Ile Val Cys His Ala Ile Glu Arg
           355                     360                 365
Met Lys Glu Val Val Arg Asn Tyr Asn Val Glu Ser Thr Trp Phe Ile
       370                     375                 380
Glu Gly Tyr Thr Pro Pro Val Ser Glu Tyr Leu Ser Asn Ala Leu Ala
385                     390                     395                 400
Thr Thr Thr Tyr Tyr Tyr Leu Ala Thr Thr Ser Tyr Leu Gly Met Lys
               405                     410                 415
Ser Ala Thr Glu Gln Asp Phe Glu Trp Leu Ser Lys Asn Pro Lys Ile
           420                     425                 430
Leu Glu Ala Ser Val Ile Ile Cys Arg Val Ile Asp Asp Thr Ala Thr
       435                     440                 445
Tyr Glu Val Glu Lys Ser Arg Gly Gln Ile Ala Thr Gly Ile Glu Cys
   450                     455                 460
Cys Met Arg Asp Tyr Gly Ile Ser Thr Lys Glu Ala Met Ala Lys Phe
465                     470                     475                 480
Gln Asn Met Ala Glu Thr Ala Trp Lys Asp Ile Asn Glu Gly Leu Leu
               485                     490                 495
Arg Pro Thr Pro Val Ser Thr Glu Phe Leu Thr Pro Ile Leu Asn Leu
           500                     505                 510
Ala Arg Ile Val Glu Val Thr Tyr Ile His Asn Leu Asp Gly Tyr Thr
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His Pro Glu Lys Val Leu Lys Pro His Ile Ile Asn Leu Leu Val Asp
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Ser Ile Lys Ile
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 gtc gcc gac ttc tcc cct agt ctc tgg ggt gat cag ttc ctt tca ttc     96
 Val Ala Asp Phe Ser Pro Ser Leu Trp Gly Asp Gln Phe Leu Ser Phe
             20                  25                  30

 tcc att gat aat cag gtt gcg gaa aag tat gct caa gag att gaa gca    144
 Ser Ile Asp Asn Gln Val Ala Glu Lys Tyr Ala Gln Glu Ile Glu Ala
             35                  40                  45

 ttg aag gaa caa acg agg agt atg ctg tta gca acc gga agg aaa ttg    192
 Leu Lys Glu Gln Thr Arg Ser Met Leu Leu Ala Thr Gly Arg Lys Leu
     50                  55                  60

 gcc gat aca ttg aat ttg att gac att att gaa cgc ctt ggt ata tcc    240
 Ala Asp Thr Leu Asn Leu Ile Asp Ile Ile Glu Arg Leu Gly Ile Ser
 65                  70                  75                  80
```

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tac cac ttt gag aaa gaa att gat gag att ttg gat cag att tac aac        288
Tyr His Phe Glu Lys Glu Ile Asp Glu Ile Leu Asp Gln Ile Tyr Asn
                85                  90                  95

caa aac tca aac tgc aat gat ttg tgc acc tct gca ctt caa ttt cga        336
Gln Asn Ser Asn Cys Asn Asp Leu Cys Thr Ser Ala Leu Gln Phe Arg
               100                 105                 110

ttg ctc agg caa cac ggt ttc aac atc tct cct gaa att ttc agc aaa        384
Leu Leu Arg Gln His Gly Phe Asn Ile Ser Pro Glu Ile Phe Ser Lys
               115                 120                 125

ttc caa gat gaa aat ggc aaa ttc aag gag tct ctt gct agt gat gtc        432
Phe Gln Asp Glu Asn Gly Lys Phe Lys Glu Ser Leu Ala Ser Asp Val
           130                 135                 140

tta gga tta tta aac ttg tat gaa gct tca cat gta agg act cat gct        480
Leu Gly Leu Leu Asn Leu Tyr Glu Ala Ser His Val Arg Thr His Ala
145                 150                 155                 160

gac gat atc tta gaa gac gca ctt gct ttc tcc act atc cat ctt gaa        528
Asp Asp Ile Leu Glu Asp Ala Leu Ala Phe Ser Thr Ile His Leu Glu
               165                 170                 175

tct gca gct cca cat ttg aaa tct cca ctt agg gag caa gtg aca cat        576
Ser Ala Ala Pro His Leu Lys Ser Pro Leu Arg Glu Gln Val Thr His
               180                 185                 190

gcc ctt gag caa tgt ttg cac aag ggt gtt cct aga gtc gag acc cga        624
Ala Leu Glu Gln Cys Leu His Lys Gly Val Pro Arg Val Glu Thr Arg
               195                 200                 205

ttc ttc atc tca tca atc tat gac aag gaa caa tcg aag aat aat gtg        672
Phe Phe Ile Ser Ser Ile Tyr Asp Lys Glu Gln Ser Lys Asn Asn Val
           210                 215                 220

tta ctt cga ttt gcc aaa ttg gat ttc aac ttg ctc cag atg ttg cac        720
Leu Leu Arg Phe Ala Lys Leu Asp Phe Asn Leu Leu Gln Met Leu His
225                 230                 235                 240

aaa caa gaa ctt gct caa gta tca agg tgg tgg aaa gat ttg gat ttt        768
Lys Gln Glu Leu Ala Gln Val Ser Arg Trp Trp Lys Asp Leu Asp Phe
               245                 250                 255

gta aca aca ctt cca tat gct aga gat cga gta gtt gaa tgc tac ttt        816
Val Thr Thr Leu Pro Tyr Ala Arg Asp Arg Val Val Glu Cys Tyr Phe
               260                 265                 270

gag gca tta gga gtt tat ttt gag cct caa tac tct caa gct cgc gtc        864
Glu Ala Leu Gly Val Tyr Phe Glu Pro Gln Tyr Ser Gln Ala Arg Val
               275                 280                 285

atg ctc gtt aag acc ata tca atg att tcg att gtc gat gac acc ttt        912
Met Leu Val Lys Thr Ile Ser Met Ile Ser Ile Val Asp Asp Thr Phe
           290                 295                 300
```

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gat gct tac ggt aca gtt aaa gaa ctt gag gca tac aca gat gcc ata        960
Asp Ala Tyr Gly Thr Val Lys Glu Leu Glu Ala Tyr Thr Asp Ala Ile
305             310             315             320

caa aga tgg gat atc aac gaa att gat cgg ctt cct gat tac atg aaa        1008
Gln Arg Trp Asp Ile Asn Glu Ile Asp Arg Leu Pro Asp Tyr Met Lys
                325             330             335

atc agt tat aaa gct att cta gat ctc tac aag gat tat gaa aag gaa        1056
Ile Ser Tyr Lys Ala Ile Leu Asp Leu Tyr Lys Asp Tyr Glu Lys Glu
            340             345             350

ttg tct agt gcc gga aga tct cat att gtc tgc cat gca ata gaa aga        1104
Leu Ser Ser Ala Gly Arg Ser His Ile Val Cys His Ala Ile Glu Arg
            355             360             365

atg aaa gaa gta gta aga aat tat aat gtc gag tca aca tgg ttt att        1152
Met Lys Glu Val Val Arg Asn Tyr Asn Val Glu Ser Thr Trp Phe Ile
    370             375             380

gaa gga tat atg cca cct gtt tct gaa tac cta agc aat gca cta gca        1200
Glu Gly Tyr Met Pro Pro Val Ser Glu Tyr Leu Ser Asn Ala Leu Ala
385             390             395             400

act acc aca tat tac tac ctc gcg aca aca tcg tat ttg ggc atg aag        1248
Thr Thr Thr Tyr Tyr Tyr Leu Ala Thr Thr Ser Tyr Leu Gly Met Lys
                405             410             415

tct gcc acg gag caa gat ttt gag tgg ttg tca aag aat cca aaa att        1296
Ser Ala Thr Glu Gln Asp Phe Glu Trp Leu Ser Lys Asn Pro Lys Ile
            420             425             430

ctt gaa gct agt gta att ata tgt cga gtt atc gat gac aca gcc acg        1344
Leu Glu Ala Ser Val Ile Ile Cys Arg Val Ile Asp Asp Thr Ala Thr
            435             440             445

tac gag gtt gag aaa agc agg gga caa att gca act gga att gag tgc        1392
Tyr Glu Val Glu Lys Ser Arg Gly Gln Ile Ala Thr Gly Ile Glu Cys
    450             455             460

tgc atg aga gat tat ggt ata tca aca aaa gag gca atg gct aaa ttt        1440
Cys Met Arg Asp Tyr Gly Ile Ser Thr Lys Glu Ala Met Ala Lys Phe
465             470             475             480

caa aat atg gct gag aca gca tgg aaa gat att aat gaa gga ctt ctt        1488
Gln Asn Met Ala Glu Thr Ala Trp Lys Asp Ile Asn Glu Gly Leu Leu
                485             490             495

agg ccc act ccc gtc tct aca gaa ttt tta act cct att ctc aat ctt        1536
Arg Pro Thr Pro Val Ser Thr Glu Phe Leu Thr Pro Ile Leu Asn Leu
                500             505             510

gct cgt att gtt gag gtt aca tat ata cac aat cta gat gga tac act        1584
Ala Arg Ile Val Glu Val Thr Tyr Ile His Asn Leu Asp Gly Tyr Thr
            515             520             525

cat ccg gag aaa gtc tta aaa cct cac att att aac cta ctt gtg gac        1632
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His Pro Glu Lys Val Leu Lys Pro His Ile Ile Asn Leu Leu Val Asp
    530                 535                 540
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Ser Ile Lys Ile
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<213> Nicotiana tabacum

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Ser Ile Asp Asn Gln Val Ala Glu Lys Tyr Ala Gln Glu Ile Glu Ala
        35                  40                  45
Leu Lys Glu Gln Thr Arg Ser Met Leu Leu Ala Thr Gly Arg Lys Leu
    50                  55                  60
Ala Asp Thr Leu Asn Leu Ile Asp Ile Ile Glu Arg Leu Gly Ile Ser
65                  70                  75                  80
Tyr His Phe Glu Lys Glu Ile Asp Glu Ile Leu Asp Gln Ile Tyr Asn
                85                  90                  95
Gln Asn Ser Asn Cys Asn Asp Leu Cys Thr Ser Ala Leu Gln Phe Arg
            100                 105                 110
Leu Leu Arg Gln His Gly Phe Asn Ile Ser Pro Glu Ile Phe Ser Lys
    115                 120                 125
Phe Gln Asp Glu Asn Gly Lys Phe Lys Glu Ser Leu Ala Ser Asp Val
    130                 135                 140
Leu Gly Leu Leu Asn Leu Tyr Glu Ala Ser His Val Arg Thr His Ala
145                 150                 155                 160
Asp Asp Ile Leu Glu Asp Ala Leu Ala Phe Ser Thr Ile His Leu Glu
                165                 170                 175
Ser Ala Ala Pro His Leu Lys Ser Pro Leu Arg Glu Gln Val Thr His
            180                 185                 190
Ala Leu Glu Gln Cys Leu His Lys Gly Val Pro Arg Val Glu Thr Arg
        195                 200                 205
Phe Phe Ile Ser Ser Ile Tyr Asp Lys Glu Gln Ser Lys Asn Asn Val
    210                 215                 220
Leu Leu Arg Phe Ala Lys Leu Asp Phe Asn Leu Leu Gln Met Leu His
225                 230                 235                 240
Lys Gln Glu Leu Ala Gln Val Ser Arg Trp Trp Lys Asp Leu Asp Phe
                245                 250                 255
Val Thr Thr Leu Pro Tyr Ala Arg Asp Arg Val Val Glu Cys Tyr Phe
            260                 265                 270
Glu Ala Leu Gly Val Tyr Phe Glu Pro Gln Tyr Ser Gln Ala Arg Val
        275                 280                 285
Met Leu Val Lys Thr Ile Ser Met Ile Ser Ile Val Asp Asp Thr Phe
    290                 295                 300
Asp Ala Tyr Gly Thr Val Lys Glu Leu Glu Ala Tyr Thr Asp Ala Ile
305                 310                 315                 320
Gln Arg Trp Asp Ile Asn Glu Ile Asp Arg Leu Pro Asp Tyr Met Lys
                325                 330                 335
Ile Ser Tyr Lys Ala Ile Leu Asp Leu Tyr Lys Asp Tyr Glu Lys Glu
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                340                    345                     350
Leu Ser Ser Ala Gly Arg Ser His Ile Val Cys His Ala Ile Glu Arg
        355                    360                 365
Met Lys Glu Val Val Arg Asn Tyr Asn Val Glu Ser Thr Trp Phe Ile
    370                    375                 380
Glu Gly Tyr Met Pro Pro Val Ser Glu Tyr Leu Ser Asn Ala Leu Ala
385                    390                 395                    400
Thr Thr Thr Tyr Tyr Tyr Leu Ala Thr Thr Ser Tyr Leu Gly Met Lys
                405                    410                 415
Ser Ala Thr Glu Gln Asp Phe Glu Trp Leu Ser Lys Asn Pro Lys Ile
                420                    425                 430
Leu Glu Ala Ser Val Ile Ile Cys Arg Val Ile Asp Asp Thr Ala Thr
            435                    440                 445
Tyr Glu Val Glu Lys Ser Arg Gly Gln Ile Ala Thr Gly Ile Glu Cys
    450                    455                 460
Cys Met Arg Asp Tyr Gly Ile Ser Thr Lys Glu Ala Met Ala Lys Phe
465                    470                    475                 480
Gln Asn Met Ala Glu Thr Ala Trp Lys Asp Ile Asn Glu Gly Leu Leu
                485                    490                 495
Arg Pro Thr Pro Val Ser Thr Glu Phe Leu Thr Pro Ile Leu Asn Leu
                500                    505                 510
Ala Arg Ile Val Glu Val Thr Tyr Ile His Asn Leu Asp Gly Tyr Thr
                515                    520                 525
His Pro Glu Lys Val Leu Lys Pro His Ile Ile Asn Leu Leu Val Asp
    530                    535                 540
Ser Ile Lys Ile
545


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<213> Nicotiana tabacum

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<222> (1)...(1644)

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 Met Ala Ser Ala Ala Val Ala Asn Tyr Glu Glu Glu Ile Val Arg Pro
 1               5                   10                  15

 gtc gcc gac ttc tcc cct agt ctc tgg ggt gat cag ttc ctt tca ttc      96
 Val Ala Asp Phe Ser Pro Ser Leu Trp Gly Asp Gln Phe Leu Ser Phe
                 20                  25                  30

 tcc att gat aat cag gtt gcg gaa aag tat gct caa gag att gaa gca     144
 Ser Ile Asp Asn Gln Val Ala Glu Lys Tyr Ala Gln Glu Ile Glu Ala
             35                  40                  45

 ttg aag gaa caa acg agg agt atg ctg tta gca acc gga agg aaa ttg     192
 Leu Lys Glu Gln Thr Arg Ser Met Leu Leu Ala Thr Gly Arg Lys Leu
     50                  55                  60

 gcc gat aca ttg aat ttg att gac att att gaa cgc ctt ggt ata tcc     240
 Ala Asp Thr Leu Asn Leu Ile Asp Ile Ile Glu Arg Leu Gly Ile Ser
 65                  70                  75                  80
```

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tac cac ttt gag aaa gaa att gat gag att ttg gat cag att tac aac        288
Tyr His Phe Glu Lys Glu Ile Asp Glu Ile Leu Asp Gln Ile Tyr Asn
                85                  90                  95

caa aac tca aac tgc aat gat ttg tgc acc tct gca ctt caa ttt cga        336
Gln Asn Ser Asn Cys Asn Asp Leu Cys Thr Ser Ala Leu Gln Phe Arg
               100                 105                 110

ttg ctc agg caa cac ggt ttc aac atc tct cct gaa att ttc agc aaa        384
Leu Leu Arg Gln His Gly Phe Asn Ile Ser Pro Glu Ile Phe Ser Lys
               115                 120                 125

ttc caa gat gaa aat ggc aaa ttc aag gag tct ctt gct agt gat gtc        432
Phe Gln Asp Glu Asn Gly Lys Phe Lys Glu Ser Leu Ala Ser Asp Val
           130                 135                 140

tta gga tta tta aac ttg tat gaa gct tca cat gta agg act cat gct        480
Leu Gly Leu Leu Asn Leu Tyr Glu Ala Ser His Val Arg Thr His Ala
145                 150                 155                 160

gac gat atc tta gaa gac gca ctt gct ttc tcc act atc cat ctt gaa        528
Asp Asp Ile Leu Glu Asp Ala Leu Ala Phe Ser Thr Ile His Leu Glu
                   165                 170                 175

tct gca gct cca cat ttg aaa tct cca ctt agg gag caa gtg aca cat        576
Ser Ala Ala Pro His Leu Lys Ser Pro Leu Arg Glu Gln Val Thr His
               180                 185                 190

gcc ctt gag caa tgt ttg cac aag ggt gtt cct aga gtc gag acc cga        624
Ala Leu Glu Gln Cys Leu His Lys Gly Val Pro Arg Val Glu Thr Arg
               195                 200                 205

ttc ttc atc tca tca atc tat gac aag gaa caa tcg aag aat aat gtg        672
Phe Phe Ile Ser Ser Ile Tyr Asp Lys Glu Gln Ser Lys Asn Asn Val
           210                 215                 220

tta ctt cga ttt gcc aaa ttg gat ttc aac ttg ctc cag atg ttg cac        720
Leu Leu Arg Phe Ala Lys Leu Asp Phe Asn Leu Leu Gln Met Leu His
225                 230                 235                 240

aaa caa gaa ctt gct caa gta tca agg tgg tgg aaa gat ttg gat ttt        768
Lys Gln Glu Leu Ala Gln Val Ser Arg Trp Trp Lys Asp Leu Asp Phe
               245                 250                 255

gta aca aca ctt cca tat gct aga gat cga gta gtt gaa tgc tac ttt        816
Val Thr Thr Leu Pro Tyr Ala Arg Asp Arg Val Val Glu Cys Tyr Phe
               260                 265                 270

tgg gca tta gga gtt tat ttt gag cct caa tac tct caa gct cgc gtc        864
Trp Ala Leu Gly Val Tyr Phe Glu Pro Gln Tyr Ser Gln Ala Arg Val
               275                 280                 285

atg ctc gtt aag acc ata tca atg att tcg att gtc gat gac acc ttt        912
Met Leu Val Lys Thr Ile Ser Met Ile Ser Ile Val Asp Asp Thr Phe
           290                 295                 300
```

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gat gct tac ggt aca gtt aaa gaa ctt gag gca tac aca gat gcc ata        960
Asp Ala Tyr Gly Thr Val Lys Glu Leu Glu Ala Tyr Thr Asp Ala Ile
305             310             315             320

caa aga tgg gat atc aac gaa att gat cgg ctt cct gat tac atg aaa       1008
Gln Arg Trp Asp Ile Asn Glu Ile Asp Arg Leu Pro Asp Tyr Met Lys
                325             330             335

atc agt tat aaa gct att cta gat ctc tac aag gat tat gaa aag gaa       1056
Ile Ser Tyr Lys Ala Ile Leu Asp Leu Tyr Lys Asp Tyr Glu Lys Glu
                340             345             350

ttg tct agt gcc gga aga tct cat att gtc tgc cat gca ata gaa aga       1104
Leu Ser Ser Ala Gly Arg Ser His Ile Val Cys His Ala Ile Glu Arg
            355             360             365

atg aaa gaa gta gta aga aat tat aat gtc gag tca aca tgg ttt att       1152
Met Lys Glu Val Val Arg Asn Tyr Asn Val Glu Ser Thr Trp Phe Ile
    370             375             380

gaa gga tat atg cca cct gtt tct gaa tac cta agc aat gca cta gca       1200
Glu Gly Tyr Met Pro Pro Val Ser Glu Tyr Leu Ser Asn Ala Leu Ala
385             390             395             400

act acc aca tat tac tac ctc gcg aca aca tcg tat ttg ggc atg aag       1248
Thr Thr Thr Tyr Tyr Tyr Leu Ala Thr Thr Ser Tyr Leu Gly Met Lys
                405             410             415

tct gcc acg gag caa gat ttt gag tgg ttg tca aag aat cca aaa att       1296
Ser Ala Thr Glu Gln Asp Phe Glu Trp Leu Ser Lys Asn Pro Lys Ile
            420             425             430

ctt gaa gct agt gta att ata tgt cga gtt atc gat gac aca gcc acg       1344
Leu Glu Ala Ser Val Ile Ile Cys Arg Val Ile Asp Asp Thr Ala Thr
            435             440             445

tac gag gtt gag aaa agc agg gga caa att gca act gga att gag tgc       1392
Tyr Glu Val Glu Lys Ser Arg Gly Gln Ile Ala Thr Gly Ile Glu Cys
    450             455             460

tgc atg aga gat tat ggt ata tca aca aaa gag gca atg gct aaa ttt       1440
Cys Met Arg Asp Tyr Gly Ile Ser Thr Lys Glu Ala Met Ala Lys Phe
465             470             475             480

caa aat atg gct gag aca gca tgg aaa gat att aat gaa gga ctt ctt       1488
Gln Asn Met Ala Glu Thr Ala Trp Lys Asp Ile Asn Glu Gly Leu Leu
                485             490             495

agg ccc act ccc gtc tct aca gaa ttt tta act cct att ctc aat ctt       1536
Arg Pro Thr Pro Val Ser Thr Glu Phe Leu Thr Pro Ile Leu Asn Leu
                500             505             510

gct cgt att gtt gag gtt aca ttc ata cac aat cta gat gga tac act       1584
Ala Arg Ile Val Glu Val Thr Phe Ile His Asn Leu Asp Gly Tyr Thr
            515             520             525

cat ccg gag aaa gtc tta aaa cct cac att att aac cta ctt gtg gac       1632
His Pro Glu Lys Val Leu Lys Pro His Ile Ile Asn Leu Leu Val Asp
```

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His Pro Glu Lys Val Leu Lys Pro His Ile Ile Asn Leu Leu Val Asp
    530                 535             540

tcc atc aaa att                                                 1644
Ser Ile Lys Ile
545


<210> 6
<211> 548
<212> PRT
<213> Nicotiana tabacum

<400> 6
Met Ala Ser Ala Ala Val Ala Asn Tyr Glu Glu Glu Ile Val Arg Pro
 1               5                  10                  15
Val Ala Asp Phe Ser Pro Ser Leu Trp Gly Asp Gln Phe Leu Ser Phe
            20                  25                  30
Ser Ile Asp Asn Gln Val Ala Glu Lys Tyr Ala Gln Glu Ile Glu Ala
            35                  40                  45
Leu Lys Glu Gln Thr Arg Ser Met Leu Leu Ala Thr Gly Arg Lys Leu
    50                  55                  60
Ala Asp Thr Leu Asn Leu Ile Asp Ile Ile Glu Arg Leu Gly Ile Ser
65                  70                  75                  80
Tyr His Phe Glu Lys Glu Ile Asp Glu Ile Leu Asp Gln Ile Tyr Asn
                85                  90                  95
Gln Asn Ser Asn Cys Asn Asp Leu Cys Thr Ser Ala Leu Gln Phe Arg
            100                 105                 110
Leu Leu Arg Gln His Gly Phe Asn Ile Ser Pro Glu Ile Phe Ser Lys
            115                 120                 125
Phe Gln Asp Glu Asn Gly Lys Phe Lys Glu Ser Leu Ala Ser Asp Val
    130                 135                 140
Leu Gly Leu Leu Asn Leu Tyr Glu Ala Ser His Val Arg Thr His Ala
145                 150                 155                 160
Asp Asp Ile Leu Glu Asp Ala Leu Ala Phe Ser Thr Ile His Leu Glu
                165                 170                 175
Ser Ala Ala Pro His Leu Lys Ser Pro Leu Arg Glu Gln Val Thr His
            180                 185                 190
Ala Leu Glu Gln Cys Leu His Lys Gly Val Pro Arg Val Glu Thr Arg
            195                 200                 205
Phe Phe Ile Ser Ser Ile Tyr Asp Lys Glu Gln Ser Lys Asn Asn Val
    210                 215                 220
Leu Leu Arg Phe Ala Lys Leu Asp Phe Asn Leu Leu Gln Met Leu His
225                 230                 235                 240
Lys Gln Glu Leu Ala Gln Val Ser Arg Trp Trp Lys Asp Leu Asp Phe
                245                 250                 255
Val Thr Thr Leu Pro Tyr Ala Arg Asp Arg Val Val Glu Cys Tyr Phe
            260                 265                 270
Trp Ala Leu Gly Val Tyr Phe Glu Pro Gln Tyr Ser Gln Ala Arg Val
            275                 280                 285
Met Leu Val Lys Thr Ile Ser Met Ile Ser Ile Val Asp Asp Thr Phe
    290                 295                 300
Asp Ala Tyr Gly Thr Val Lys Glu Leu Glu Ala Tyr Thr Asp Ala Ile
305                 310                 315                 320
Gln Arg Trp Asp Ile Asn Glu Ile Asp Arg Leu Pro Asp Tyr Met Lys
                325                 330                 335
Ile Ser Tyr Lys Ala Ile Leu Asp Leu Tyr Lys Asp Tyr Glu Lys Glu
```

```
                340                    345                    350
Leu Ser Ser Ala Gly Arg Ser His Ile Val Cys His Ala Ile Glu Arg
            355                    360                    365
Met Lys Glu Val Val Arg Asn Tyr Asn Val Glu Ser Thr Trp Phe Ile
            370                    375                    380
Glu Gly Tyr Met Pro Pro Val Ser Glu Tyr Leu Ser Asn Ala Leu Ala
385                    390                    395                    400
Thr Thr Thr Tyr Tyr Tyr Leu Ala Thr Thr Ser Tyr Leu Gly Met Lys
                405                    410                    415
Ser Ala Thr Glu Gln Asp Phe Glu Trp Leu Ser Lys Asn Pro Lys Ile
            420                    425                    430
Leu Glu Ala Ser Val Ile Ile Cys Arg Val Ile Asp Asp Thr Ala Thr
            435                    440                    445
Tyr Glu Val Glu Lys Ser Arg Gly Gln Ile Ala Thr Gly Ile Glu Cys
    450                    455                    460
Cys Met Arg Asp Tyr Gly Ile Ser Thr Lys Glu Ala Met Ala Lys Phe
465                    470                    475                    480
Gln Asn Met Ala Glu Thr Ala Trp Lys Asp Ile Asn Glu Gly Leu Leu
                485                    490                    495
Arg Pro Thr Pro Val Ser Thr Glu Phe Leu Thr Pro Ile Leu Asn Leu
            500                    505                    510
Ala Arg Ile Val Glu Val Thr Phe Ile His Asn Leu Asp Gly Tyr Thr
            515                    520                    525
His Pro Glu Lys Val Leu Lys Pro His Ile Ile Asn Leu Leu Val Asp
            530                    535                    540
Ser Ile Lys Ile
545


<210> 7
<211> 1644
<212> DNA
<213> Nicotiana tabacum

<220>
<221> CDS
<222> (1)...(1644)

<400> 7
 atg gcc tca gca gca gtt gca aac tat gaa gaa gag att gtt cgc ccc      48
 Met Ala Ser Ala Ala Val Ala Asn Tyr Glu Glu Glu Ile Val Arg Pro
 1               5                  10                  15

 gtc gcc gac ttc tcc cct agt ctc tgg ggt gat cag ttc ctt tca ttc      96
 Val Ala Asp Phe Ser Pro Ser Leu Trp Gly Asp Gln Phe Leu Ser Phe
                20                  25                  30

 tcc att gat aat cag gtt gcg gaa aag tat gct caa gag att gaa gca     144
 Ser Ile Asp Asn Gln Val Ala Glu Lys Tyr Ala Gln Glu Ile Glu Ala
                35                  40                  45

 ttg aag gaa caa acg agg agt atg ctg tta gca acc gga agg aaa ttg     192
 Leu Lys Glu Gln Thr Arg Ser Met Leu Leu Ala Thr Gly Arg Lys Leu
     50                  55                  60

 gcc gat aca ttg aat ttg att gac att att gaa cgc ctt ggt ata tcc     240
 Ala Asp Thr Leu Asn Leu Ile Asp Ile Ile Glu Arg Leu Gly Ile Ser
 65                  70                  75                  80
```

```
tac cac ttt gag aaa gaa att gat gag att ttg gat cag att tac aac        288
Tyr His Phe Glu Lys Glu Ile Asp Glu Ile Leu Asp Gln Ile Tyr Asn
                85              90                  95

caa aac tca aac tgc aat gat ttg tgc acc tct gca ctt caa ttt cga        336
Gln Asn Ser Asn Cys Asn Asp Leu Cys Thr Ser Ala Leu Gln Phe Arg
            100             105                 110

ttg ctc agg caa cac ggt ttc aac atc tct cct gaa att ttc agc aaa        384
Leu Leu Arg Gln His Gly Phe Asn Ile Ser Pro Glu Ile Phe Ser Lys
        115             120             125

ttc caa gat gaa aat ggc aaa ttc aag gag tct ctt gct agt gat gtc        432
Phe Gln Asp Glu Asn Gly Lys Phe Lys Glu Ser Leu Ala Ser Asp Val
    130             135             140

tta gga tta tta aac ttg tat gaa gct tca cat gta agg act cat gct        480
Leu Gly Leu Leu Asn Leu Tyr Glu Ala Ser His Val Arg Thr His Ala
145             150             155             160

gac gat atc tta gaa gac gca ctt gct ttc tcc act atc cat ctt gaa        528
Asp Asp Ile Leu Glu Asp Ala Leu Ala Phe Ser Thr Ile His Leu Glu
                165             170             175

tct gca gct cca cat ttg aaa tct cca ctt agg gag caa gtg aca cat        576
Ser Ala Ala Pro His Leu Lys Ser Pro Leu Arg Glu Gln Val Thr His
            180             185             190

gcc ctt gag caa tgt ttg cac aag ggt gtt cct aga gtc gag acc cga        624
Ala Leu Glu Gln Cys Leu His Lys Gly Val Pro Arg Val Glu Thr Arg
        195             200             205

ttc ttc atc tca tca atc tat gac aag gaa caa tcg aag aat aat gtg        672
Phe Phe Ile Ser Ser Ile Tyr Asp Lys Glu Gln Ser Lys Asn Asn Val
    210             215             220

tta ctt cga ttt gcc aaa ttg gat ttc aac ttg ctc cag atg ttg cac        720
Leu Leu Arg Phe Ala Lys Leu Asp Phe Asn Leu Leu Gln Met Leu His
225             230             235             240

aaa caa gaa ctt gct caa gta tca agg tgg tgg aaa gat ttg gat ttt        768
Lys Gln Glu Leu Ala Gln Val Ser Arg Trp Trp Lys Asp Leu Asp Phe
            245             250             255

gta aca aca ctt cca tat gct aga gat cga gta gtt gaa tgc tac ttt        816
Val Thr Thr Leu Pro Tyr Ala Arg Asp Arg Val Val Glu Cys Tyr Phe
            260             265             270

tgg gca tta gga gtt tat ttt gag cct caa tac tct caa gct cgc gtc        864
Trp Ala Leu Gly Val Tyr Phe Glu Pro Gln Tyr Ser Gln Ala Arg Val
        275             280             285

atg ctc gtt aag acc ata tca atg att tcg att gtc gat gac acc ttt        912
Met Leu Val Lys Thr Ile Ser Met Ile Ser Ile Val Asp Asp Thr Phe
        290             295             300
```

```
gat gct tac ggt aca gtt aaa gaa ctt gag gca tac aca gat gcc ata    960
Asp Ala Tyr Gly Thr Val Lys Glu Leu Glu Ala Tyr Thr Asp Ala Ile
305             310             315             320

caa aga tgg gat atc aac gaa att gat cgg ctt cct gat tac atg aaa    1008
Gln Arg Trp Asp Ile Asn Glu Ile Asp Arg Leu Pro Asp Tyr Met Lys
            325             330             335

atc agt tat aaa gct att cta gat ctc tac aag gat tat gaa aag gaa    1056
Ile Ser Tyr Lys Ala Ile Leu Asp Leu Tyr Lys Asp Tyr Glu Lys Glu
            340             345             350

ttg tct agt gcc gga aga tct cat att gtc tgc cat gca ata gaa aga    1104
Leu Ser Ser Ala Gly Arg Ser His Ile Val Cys His Ala Ile Glu Arg
            355             360             365

atg aaa gaa gta gta aga aat tat aat gtc gag tca aca tgg ttt att    1152
Met Lys Glu Val Val Arg Asn Tyr Asn Val Glu Ser Thr Trp Phe Ile
370             375             380

gaa gga tat atg cca cct gtt tct gaa tac cta agc aat gca cta gca    1200
Glu Gly Tyr Met Pro Pro Val Ser Glu Tyr Leu Ser Asn Ala Leu Ala
385             390             395             400

act acc aca tat tac tac ctc gcg aca aca tcg tat ttg ggc atg aag    1248
Thr Thr Thr Tyr Tyr Tyr Leu Ala Thr Thr Ser Tyr Leu Gly Met Lys
                405             410             415

tct gcc acg gag caa gat ttt gag tgg ttg tca aag aat cca aaa att    1296
Ser Ala Thr Glu Gln Asp Phe Glu Trp Leu Ser Lys Asn Pro Lys Ile
            420             425             430

ctt gaa gct agt gta att ata tgt cga gtt atc gat gac aca gcc acg    1344
Leu Glu Ala Ser Val Ile Ile Cys Arg Val Ile Asp Asp Thr Ala Thr
            435             440             445

tac gag gtt gag aaa agc agg gga caa att gca act gga att gag tgc    1392
Tyr Glu Val Glu Lys Ser Arg Gly Gln Ile Ala Thr Gly Ile Glu Cys
    450             455             460

tgc atg aga gat tat ggt ata tca aca aaa gag gca atg gct aaa ttt    1440
Cys Met Arg Asp Tyr Gly Ile Ser Thr Lys Glu Ala Met Ala Lys Phe
465             470             475             480

caa aat atg gct gag aca gca tgg aaa gat att aat gaa gga ctt ctt    1488
Gln Asn Met Ala Glu Thr Ala Trp Lys Asp Ile Asn Glu Gly Leu Leu
            485             490             495

agg ccc act ccc gtc tct aca gaa ttt tta act cct att ctc aat ctt    1536
Arg Pro Thr Pro Val Ser Thr Glu Phe Leu Thr Pro Ile Leu Asn Leu
            500             505             510

gct cgt att gtt gag gtt aca tat ata cac aat cta gat gga ttc act    1584
Ala Arg Ile Val Glu Val Thr Tyr Ile His Asn Leu Asp Gly Phe Thr
            515             520             525

cat ccg gag aaa gtc tta aaa cct cac att att aac cta ctt gtg gac    1632
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His Pro Glu Lys Val Leu Lys Pro His Ile Ile Asn Leu Leu Val Asp
    530   535   540

tcc atc aaa att   1644
Ser Ile Lys Ile
545

<210> 8
<211> 548
<212> PRT
<213> Nicotiana tabacum

<400> 8
Met Ala Ser Ala Ala Val Ala Asn Tyr Glu Glu Glu Ile Val Arg Pro
1   5   10   15
Val Ala Asp Phe Ser Pro Ser Leu Trp Gly Asp Gln Phe Leu Ser Phe
         20   25   30
Ser Ile Asp Asn Gln Val Ala Glu Lys Tyr Ala Gln Glu Ile Glu Ala
      35   40   45
Leu Lys Glu Gln Thr Arg Ser Met Leu Leu Ala Thr Gly Arg Lys Leu
    50   55   60
Ala Asp Thr Leu Asn Leu Ile Asp Ile Ile Glu Arg Leu Gly Ile Ser
65   70   75   80
Tyr His Phe Glu Lys Glu Ile Asp Glu Ile Leu Asp Gln Ile Tyr Asn
         85   90   95
Gln Asn Ser Asn Cys Asn Asp Leu Cys Thr Ser Ala Leu Gln Phe Arg
        100   105   110
Leu Leu Arg Gln His Gly Phe Asn Ile Ser Pro Glu Ile Phe Ser Lys
      115   120   125
Phe Gln Asp Glu Asn Gly Lys Phe Lys Glu Ser Leu Ala Ser Asp Val
    130   135   140
Leu Gly Leu Leu Asn Leu Tyr Glu Ala Ser His Val Arg Thr His Ala
145   150   155   160
Asp Asp Ile Leu Glu Asp Ala Leu Ala Phe Ser Thr Ile His Leu Glu
         165   170   175
Ser Ala Ala Pro His Leu Lys Ser Pro Leu Arg Glu Gln Val Thr His
        180   185   190
Ala Leu Glu Gln Cys Leu His Lys Gly Val Pro Arg Val Glu Thr Arg
      195   200   205
Phe Phe Ile Ser Ser Ile Tyr Asp Lys Glu Gln Ser Lys Asn Asn Val
    210   215   220
Leu Leu Arg Phe Ala Lys Leu Asp Phe Asn Leu Leu Gln Met Leu His
225   230   235   240
Lys Gln Glu Leu Ala Gln Val Ser Arg Trp Trp Lys Asp Leu Asp Phe
        245   250   255
Val Thr Thr Leu Pro Tyr Ala Arg Asp Arg Val Val Glu Cys Tyr Phe
        260   265   270
Trp Ala Leu Gly Val Tyr Phe Glu Pro Gln Tyr Ser Gln Ala Arg Val
      275   280   285
Met Leu Val Lys Thr Ile Ser Met Ile Ser Ile Val Asp Asp Thr Phe
    290   295   300
Asp Ala Tyr Gly Thr Val Lys Glu Leu Glu Ala Tyr Thr Asp Ala Ile
305   310   315   320
Gln Arg Trp Asp Ile Asn Glu Ile Asp Arg Leu Pro Asp Tyr Met Lys
        325   330   335
Ile Ser Tyr Lys Ala Ile Leu Asp Leu Tyr Lys Asp Tyr Glu Lys Glu

```
              340                 345                 350
Leu Ser Ser Ala Gly Arg Ser His Ile Val Cys His Ala Ile Glu Arg
         355                 360                 365
Met Lys Glu Val Val Arg Asn Tyr Asn Val Glu Ser Thr Trp Phe Ile
     370                 375                 380
Glu Gly Tyr Met Pro Pro Val Ser Glu Tyr Leu Ser Asn Ala Leu Ala
385                 390                 395                 400
Thr Thr Thr Tyr Tyr Tyr Leu Ala Thr Thr Ser Tyr Leu Gly Met Lys
             405                 410                 415
Ser Ala Thr Glu Gln Asp Phe Glu Trp Leu Ser Lys Asn Pro Lys Ile
             420                 425                 430
Leu Glu Ala Ser Val Ile Ile Cys Arg Val Ile Asp Asp Thr Ala Thr
         435                 440                 445
Tyr Glu Val Glu Lys Ser Arg Gly Gln Ile Ala Thr Gly Ile Glu Cys
     450                 455                 460
Cys Met Arg Asp Tyr Gly Ile Ser Thr Lys Glu Ala Met Ala Lys Phe
465                 470                 475                 480
Gln Asn Met Ala Glu Thr Ala Trp Lys Asp Ile Asn Glu Gly Leu Leu
             485                 490                 495
Arg Pro Thr Pro Val Ser Thr Glu Phe Leu Thr Pro Ile Leu Asn Leu
             500                 505                 510
Ala Arg Ile Val Glu Val Thr Tyr Ile His Asn Leu Asp Gly Phe Thr
             515                 520                 525
His Pro Glu Lys Val Leu Lys Pro His Ile Ile Asn Leu Leu Val Asp
     530                 535                 540
Ser Ile Lys Ile
545
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<210> 9
<211> 1644
<212> DNA
<213> Nicotiana tabacum

<220>
<221> CDS
<222> (1)...(1644)

<400> 9

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 atg gcc tca gca gca gtt gca aac tat gaa gaa gag att gtt cgc ccc     48
 Met Ala Ser Ala Ala Val Ala Asn Tyr Glu Glu Glu Ile Val Arg Pro
  1               5                  10                  15

 gtc gcc gac ttc tcc cct agt ctc tgg ggt gat cag ttc ctt tca ttc     96
 Val Ala Asp Phe Ser Pro Ser Leu Trp Gly Asp Gln Phe Leu Ser Phe
              20                  25                  30

 tcc att gat aat cag gtt gcg gaa aag tat gct caa gag att gaa gca    144
 Ser Ile Asp Asn Gln Val Ala Glu Lys Tyr Ala Gln Glu Ile Glu Ala
              35                  40                  45

 ttg aag gaa caa acg agg agt atg ctg tta gca acc gga agg aaa ttg    192
 Leu Lys Glu Gln Thr Arg Ser Met Leu Leu Ala Thr Gly Arg Lys Leu
          50                  55                  60

 gcc gat aca ttg aat ttg att gac att att gaa cgc ctt ggt ata tcc    240
 Ala Asp Thr Leu Asn Leu Ile Asp Ile Ile Glu Arg Leu Gly Ile Ser
  65                  70                  75                  80
```

```
tac cac ttt gag aaa gaa att gat gag att ttg gat cag att tac aac        288
Tyr His Phe Glu Lys Glu Ile Asp Glu Ile Leu Asp Gln Ile Tyr Asn
             85                  90                  95

caa aac tca aac tgc aat gat ttg tgc acc tct gca ctt caa ttt cga        336
Gln Asn Ser Asn Cys Asn Asp Leu Cys Thr Ser Ala Leu Gln Phe Arg
            100                 105                 110

ttg ctc agg caa cac ggt ttc aac atc tct cct gaa att ttc agc aaa        384
Leu Leu Arg Gln His Gly Phe Asn Ile Ser Pro Glu Ile Phe Ser Lys
            115                 120                 125

ttc caa gat gaa aat ggc aaa ttc aag gag tct ctt gct agt gat gtc        432
Phe Gln Asp Glu Asn Gly Lys Phe Lys Glu Ser Leu Ala Ser Asp Val
    130                 135                 140

tta gga tta tta aac ttg tat gaa gct tca cat gta agg act cat gct        480
Leu Gly Leu Leu Asn Leu Tyr Glu Ala Ser His Val Arg Thr His Ala
145                 150                 155                 160

gac gat atc tta gaa gac gca ctt gct ttc tcc act atc cat ctt gaa        528
Asp Asp Ile Leu Glu Asp Ala Leu Ala Phe Ser Thr Ile His Leu Glu
                165                 170                 175

tct gca gct cca cat ttg aaa tct cca ctt agg gag caa gtg aca cat        576
Ser Ala Ala Pro His Leu Lys Ser Pro Leu Arg Glu Gln Val Thr His
            180                 185                 190

gcc ctt gag caa tgt ttg cac aag ggt gtt cct aga gtc gag acc cga        624
Ala Leu Glu Gln Cys Leu His Lys Gly Val Pro Arg Val Glu Thr Arg
            195                 200                 205

ttc ttc atc tca tca atc tat gac aag gaa caa tcg aag aat aat gtg        672
Phe Phe Ile Ser Ser Ile Tyr Asp Lys Glu Gln Ser Lys Asn Asn Val
    210                 215                 220

tta ctt cga ttt gcc aaa ttg gat ttc aac ttg ctc cag atg ttg cac        720
Leu Leu Arg Phe Ala Lys Leu Asp Phe Asn Leu Leu Gln Met Leu His
225                 230                 235                 240

aaa caa gaa ctt gct caa gta tca agg tgg tgg aaa gat ttg gat ttt        768
Lys Gln Glu Leu Ala Gln Val Ser Arg Trp Trp Lys Asp Leu Asp Phe
                245                 250                 255

gta aca aca ctt cca tat gct aga gat cga gta gtt gaa tgc tac ttt        816
Val Thr Thr Leu Pro Tyr Ala Arg Asp Arg Val Val Glu Cys Tyr Phe
                260                 265                 270

tcg gca tta gga gtt tat ttt gag cct caa tac tct caa gct cgc gtc        864
Ser Ala Leu Gly Val Tyr Phe Glu Pro Gln Tyr Ser Gln Ala Arg Val
            275                 280                 285

atg ctc gtt aag acc ata tca atg att tcg att gtc gat gac acc ttt        912
Met Leu Val Lys Thr Ile Ser Met Ile Ser Ile Val Asp Asp Thr Phe
    290                 295                 300
```

```
gat gct tac ggt aca gtt aaa gaa ctt gag gca tac aca gat gcc ata      960
Asp Ala Tyr Gly Thr Val Lys Glu Leu Glu Ala Tyr Thr Asp Ala Ile
305             310             315             320

caa aga tgg gat atc aac gaa att gat cgg ctt cct gat tac atg aaa      1008
Gln Arg Trp Asp Ile Asn Glu Ile Asp Arg Leu Pro Asp Tyr Met Lys
                325             330             335

atc agt tat aaa gct att cta gat ctc tac aag gat tat gaa aag gaa      1056
Ile Ser Tyr Lys Ala Ile Leu Asp Leu Tyr Lys Asp Tyr Glu Lys Glu
                340             345             350

ttg tct agt gcc gga aga tct cat att gtc tgc cat gca ata gaa aga      1104
Leu Ser Ser Ala Gly Arg Ser His Ile Val Cys His Ala Ile Glu Arg
            355             360             365

atg aaa gaa gta gta aga aat tat aat gtc gag tca aca tgg ttt att      1152
Met Lys Glu Val Val Arg Asn Tyr Asn Val Glu Ser Thr Trp Phe Ile
    370             375             380

gaa gga tat atg cca cct gtt tct gaa tac cta agc aat gca cta gca      1200
Glu Gly Tyr Met Pro Pro Val Ser Glu Tyr Leu Ser Asn Ala Leu Ala
385             390             395             400

act acc aca tat tac tac ctc gcg aca aca tcg tat ttg ggc atg aag      1248
Thr Thr Thr Tyr Tyr Tyr Leu Ala Thr Thr Ser Tyr Leu Gly Met Lys
                405             410             415

tct gcc acg gag caa gat ttt gag tgg ttg tca aag aat cca aaa att      1296
Ser Ala Thr Glu Gln Asp Phe Glu Trp Leu Ser Lys Asn Pro Lys Ile
                420             425             430

ctt gaa gct agt gta att ata tgg cga gtt atc gat gac aca gcc acg      1344
Leu Glu Ala Ser Val Ile Ile Trp Arg Val Ile Asp Asp Thr Ala Thr
            435             440             445

tac gag gtt gag aaa agc agg gga caa att gca act gga att gag tgc      1392
Tyr Glu Val Glu Lys Ser Arg Gly Gln Ile Ala Thr Gly Ile Glu Cys
    450             455             460

tgc atg aga gat tat ggt ata tca aca aaa gag gca atg gct aaa ttt      1440
Cys Met Arg Asp Tyr Gly Ile Ser Thr Lys Glu Ala Met Ala Lys Phe
465             470             475             480

caa aat atg gct gag aca gca tgg aaa gat att aat gaa gga ctt ctt      1488
Gln Asn Met Ala Glu Thr Ala Trp Lys Asp Ile Asn Glu Gly Leu Leu
                485             490             495

agg ccc act ccc gtc tct aca gaa ttt tta act cct att ctc aat ctt      1536
Arg Pro Thr Pro Val Ser Thr Glu Phe Leu Thr Pro Ile Leu Asn Leu
            500             505             510

gct cgt att gtt gag gtt aca tat ata cac aat cta gat gga tac act      1584
Ala Arg Ile Val Glu Val Thr Tyr Ile His Asn Leu Asp Gly Tyr Thr
            515             520             525

cat ccg gag aaa gtc tta aaa cct cac att att aac cta ctt gtg gac      1632
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His Pro Glu Lys Val Leu Lys Pro His Ile Ile Asn Leu Leu Val Asp
    530                 535                 540

tcc atc aaa att                                                    1644
Ser Ile Lys Ile
545
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<210> 10
<211> 548
<212> PRT
<213> Nicotiana tabacum

<400> 10
 Met Ala Ser Ala Ala Val Ala Asn Tyr Glu Glu Glu Ile Val Arg Pro
  1               5                  10                  15
 Val Ala Asp Phe Ser Pro Ser Leu Trp Gly Asp Gln Phe Leu Ser Phe
             20                  25                  30
 Ser Ile Asp Asn Gln Val Ala Glu Lys Tyr Ala Gln Glu Ile Glu Ala
         35                  40                  45
 Leu Lys Glu Gln Thr Arg Ser Met Leu Leu Ala Thr Gly Arg Lys Leu
     50                  55                  60
 Ala Asp Thr Leu Asn Leu Ile Asp Ile Ile Glu Arg Leu Gly Ile Ser
 65                  70                  75                  80
 Tyr His Phe Glu Lys Glu Ile Asp Glu Ile Leu Asp Gln Ile Tyr Asn
                 85                  90                  95
 Gln Asn Ser Asn Cys Asn Asp Leu Cys Thr Ser Ala Leu Gln Phe Arg
                100                 105                 110
 Leu Leu Arg Gln His Gly Phe Asn Ile Ser Pro Glu Ile Phe Ser Lys
         115                 120                 125
 Phe Gln Asp Glu Asn Gly Lys Phe Lys Glu Ser Leu Ala Ser Asp Val
     130                 135                 140
 Leu Gly Leu Leu Asn Leu Tyr Glu Ala Ser His Val Arg Thr His Ala
 145                 150                 155                 160
 Asp Asp Ile Leu Glu Asp Ala Leu Ala Phe Ser Thr Ile His Leu Glu
                 165                 170                 175
 Ser Ala Ala Pro His Leu Lys Ser Pro Leu Arg Glu Gln Val Thr His
                 180                 185                 190
 Ala Leu Glu Gln Cys Leu His Lys Gly Val Pro Arg Val Glu Thr Arg
         195                 200                 205
 Phe Phe Ile Ser Ser Ile Tyr Asp Lys Glu Gln Ser Lys Asn Asn Val
     210                 215                 220
 Leu Leu Arg Phe Ala Lys Leu Asp Phe Asn Leu Leu Gln Met Leu His
 225                 230                 235                 240
 Lys Gln Glu Leu Ala Gln Val Ser Arg Trp Trp Lys Asp Leu Asp Phe
                 245                 250                 255
 Val Thr Thr Leu Pro Tyr Ala Arg Asp Arg Val Val Glu Cys Tyr Phe
                 260                 265                 270
 Ser Ala Leu Gly Val Tyr Phe Glu Pro Gln Tyr Ser Gln Ala Arg Val
         275                 280                 285
 Met Leu Val Lys Thr Ile Ser Met Ile Ser Ile Val Asp Asp Thr Phe
     290                 295                 300
 Asp Ala Tyr Gly Thr Val Lys Glu Leu Glu Ala Tyr Thr Asp Ala Ile
 305                 310                 315                 320
 Gln Arg Trp Asp Ile Asn Glu Ile Asp Arg Leu Pro Asp Tyr Met Lys
                 325                 330                 335
 Ile Ser Tyr Lys Ala Ile Leu Asp Leu Tyr Lys Asp Tyr Glu Lys Glu
```

```
            340                    345                    350
Leu Ser Ser Ala Gly Arg Ser His Ile Val Cys His Ala Ile Glu Arg
            355                    360                    365
Met Lys Glu Val Val Arg Asn Tyr Asn Val Glu Ser Thr Trp Phe Ile
            370                    375                    380
Glu Gly Tyr Met Pro Pro Val Ser Glu Tyr Leu Ser Asn Ala Leu Ala
385                    390                    395                    400
Thr Thr Thr Tyr Tyr Tyr Leu Ala Thr Thr Ser Tyr Leu Gly Met Lys
                       405                    410                    415
Ser Ala Thr Glu Gln Asp Phe Glu Trp Leu Ser Lys Asn Pro Lys Ile
                       420                    425                    430
Leu Glu Ala Ser Val Ile Ile Trp Arg Val Ile Asp Asp Thr Ala Thr
                       435                    440                    445
Tyr Glu Val Glu Lys Ser Arg Gly Gln Ile Ala Thr Gly Ile Glu Cys
            450                    455                    460
Cys Met Arg Asp Tyr Gly Ile Ser Thr Lys Glu Ala Met Ala Lys Phe
465                    470                    475                    480
Gln Asn Met Ala Glu Thr Ala Trp Lys Asp Ile Asn Glu Gly Leu Leu
                       485                    490                    495
Arg Pro Thr Pro Val Ser Thr Glu Phe Leu Thr Pro Ile Leu Asn Leu
                       500                    505                    510
Ala Arg Ile Val Glu Val Thr Tyr Ile His Asn Leu Asp Gly Tyr Thr
                       515                    520                    525
His Pro Glu Lys Val Leu Lys Pro His Ile Ile Asn Leu Leu Val Asp
            530                    535                    540
Ser Ile Lys Ile
545
```

<210> 11
<211> 1644
<212> DNA
<213> Nicotiana tabacum

<220>
<221> CDS
<222> (1)...(1644)

<221> misc_feature
<222> (1)...(1644)
<223> n = A,T,C or G

<400> 11
```
 atg gcc tca gca gca gtt gca aac tat gaa gaa gag att gtt cgc ccc        48
 Met Ala Ser Ala Ala Val Ala Asn Tyr Glu Glu Glu Ile Val Arg Pro
 1               5                   10                  15

 gtc gcc gac ttc tcc cct agt ctc tgg ggt gat cag ttc ctt tca ttc        96
 Val Ala Asp Phe Ser Pro Ser Leu Trp Gly Asp Gln Phe Leu Ser Phe
                 20                  25                  30

 tcc att gat aat cag gtt gcg gaa aag tat gct caa gag att gaa gca       144
 Ser Ile Asp Asn Gln Val Ala Glu Lys Tyr Ala Gln Glu Ile Glu Ala
             35                  40                  45

 ttg aag gaa caa acg agg agt atg ctg tta gca acc gga agg aaa ttg       192
 Leu Lys Glu Gln Thr Arg Ser Met Leu Leu Ala Thr Gly Arg Lys Leu
          50                  55                  60
```

```
gcc gat aca ttg aat ttg att gac att att gaa cgc ctt ggt ata tcc      240
Ala Asp Thr Leu Asn Leu Ile Asp Ile Ile Glu Arg Leu Gly Ile Ser
65              70              75                  80

tac cac ttt gag aaa gaa att gat gag att ttg gat cag att tac aac      288
Tyr His Phe Glu Lys Glu Ile Asp Glu Ile Leu Asp Gln Ile Tyr Asn
                85              90                  95

caa aac tca aac tgc aat gat ttg tgc acc tct gca ctt caa ttt cga      336
Gln Asn Ser Asn Cys Asn Asp Leu Cys Thr Ser Ala Leu Gln Phe Arg
                100             105             110

ttg ctc agg caa cac ggt ttc aac atc tct cct gaa att ttc agc aaa      384
Leu Leu Arg Gln His Gly Phe Asn Ile Ser Pro Glu Ile Phe Ser Lys
            115             120             125

ttc caa gat gaa aat ggc aaa ttc aag gag tct ctt gct agt gat gtc      432
Phe Gln Asp Glu Asn Gly Lys Phe Lys Glu Ser Leu Ala Ser Asp Val
        130             135             140

tta gga tta tta aac ttg tat gaa gct tca cat gta agg act cat gct      480
Leu Gly Leu Leu Asn Leu Tyr Glu Ala Ser His Val Arg Thr His Ala
145             150             155             160

gac gat atc tta gaa gac gca ctt gct ttc tcc act atc cat ctt gaa      528
Asp Asp Ile Leu Glu Asp Ala Leu Ala Phe Ser Thr Ile His Leu Glu
                165             170             175

tct gca gct cca cat ttg aaa tct cca ctt agg gag caa gtg aca cat      576
Ser Ala Ala Pro His Leu Lys Ser Pro Leu Arg Glu Gln Val Thr His
            180             185             190

gcc ctt gag caa tgt ttg cac aag ggt gtt cct aga gtc gag acc cga      624
Ala Leu Glu Gln Cys Leu His Lys Gly Val Pro Arg Val Glu Thr Arg
            195             200             205

ttc ttc atc tca tca atc tat gac aag gaa caa tcg aag aat aat gtg      672
Phe Phe Ile Ser Ser Ile Tyr Asp Lys Glu Gln Ser Lys Asn Asn Val
        210             215             220

tta ctt cga ttt gcc aaa ttg gat ttc aac ttg ctc cag atg ttg cac      720
Leu Leu Arg Phe Ala Lys Leu Asp Phe Asn Leu Leu Gln Met Leu His
225             230             235             240

aaa caa gaa ctt gct caa gta tca agg tgg tgg aaa gat ttg gat ttt      768
Lys Gln Glu Leu Ala Gln Val Ser Arg Trp Trp Lys Asp Leu Asp Phe
            245             250             255

gta aca aca ctt cca tat gct aga gat cga gta gtt gaa tgc tac ttt      816
Val Thr Thr Leu Pro Tyr Ala Arg Asp Arg Val Val Glu Cys Tyr Phe
            260             265             270

tgg gca tta gga gtt tat ttt gag cct caa tac tct caa gct cgc gtc      864
Trp Ala Leu Gly Val Tyr Phe Glu Pro Gln Tyr Ser Gln Ala Arg Val
275             280             285
```

```
atg ctc gtt aag acc ata tca atg att tcg att gtc gat gac acc ttt    912
Met Leu Val Lys Thr Ile Ser Met Ile Ser Ile Val Asp Asp Thr Phe
    290                 295                 300

gat gct tac ggt aca gtt aaa gaa ctt gag gca tac aca gat gcc ata    960
Asp Ala Tyr Gly Thr Val Lys Glu Leu Glu Ala Tyr Thr Asp Ala Ile
305                 310                 315                 320

caa aga tgg gat atc aac gaa att gat cgg ctt cct gat tac atg aaa   1008
Gln Arg Trp Asp Ile Asn Glu Ile Asp Arg Leu Pro Asp Tyr Met Lys
                325                 330                 335

atc agt tat aaa gct att cta gat ctc tac aag gat tat gaa aag gaa   1056
Ile Ser Tyr Lys Ala Ile Leu Asp Leu Tyr Lys Asp Tyr Glu Lys Glu
                340                 345                 350

ttg tct agt gcc gga aga tct cat att gtc tgc cat gca ata gaa aga   1104
Leu Ser Ser Ala Gly Arg Ser His Ile Val Cys His Ala Ile Glu Arg
                355                 360                 365

atg aaa gaa gta gta aga aat tat aat gtc gag tca aca tgg ttt att   1152
Met Lys Glu Val Val Arg Asn Tyr Asn Val Glu Ser Thr Trp Phe Ile
    370                 375                 380

gaa gga tat atg cca cct gtt tct gaa tac cta agc aat gca cta gca   1200
Glu Gly Tyr Met Pro Pro Val Ser Glu Tyr Leu Ser Asn Ala Leu Ala
385                 390                 395                 400

act acc aca tat tac nns nns gcg aca aca tcg tat ttg ggc atg aag   1248
Thr Thr Thr Tyr Tyr Xaa Xaa Ala Thr Thr Ser Tyr Leu Gly Met Lys
                405                 410                 415

tct gcc acg gag caa gat ttt gag tgg ttg tca aag aat cca aaa att   1296
Ser Ala Thr Glu Gln Asp Phe Glu Trp Leu Ser Lys Asn Pro Lys Ile
                420                 425                 430

ctt gaa gct agt gta att ata tgt cga gtt atc gat gac aca gcc acg   1344
Leu Glu Ala Ser Val Ile Ile Cys Arg Val Ile Asp Asp Thr Ala Thr
                435                 440                 445

tac gag gtt gag aaa agc agg gga caa att gca act gga att gag tgc   1392
Tyr Glu Val Glu Lys Ser Arg Gly Gln Ile Ala Thr Gly Ile Glu Cys
    450                 455                 460

tgc atg aga gat tat ggt ata tca aca aaa gag gca atg gct aaa ttt   1440
Cys Met Arg Asp Tyr Gly Ile Ser Thr Lys Glu Ala Met Ala Lys Phe
465                 470                 475                 480

caa aat atg gct gag aca gca tgg aaa gat att aat gaa gga ctt ctt   1488
Gln Asn Met Ala Glu Thr Ala Trp Lys Asp Ile Asn Glu Gly Leu Leu
                485                 490                 495

agg ccc act ccc gtc tct aca gaa ttt tta act cct att ctc aat ctt   1536
Arg Pro Thr Pro Val Ser Thr Glu Phe Leu Thr Pro Ile Leu Asn Leu
                500                 505                 510

gct cgt att gtt gag gtt aca tat ata cac aat cta gat gga tac act   1584
```

```
Ala Arg Ile Val Glu Val Thr Tyr Ile His Asn Leu Asp Gly Tyr Thr
        515                 520                 525
```

```
cat ccg gag aaa gtc tta aaa cct cac att att aac cta ctt gtg gac    1632
His Pro Glu Lys Val Leu Lys Pro His Ile Ile Asn Leu Leu Val Asp
    530                 535                 540
```

```
tcc atc aaa att                                                    1644
Ser Ile Lys Ile
545
```

<210> 12
<211> 548
<212> PRT
<213> Nicotiana tabacum

<220>
<221> VARIANT
<222> (1)...(548)
<223> Xaa = Any Amino Acid

<400> 12
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Met Ala Ser Ala Ala Val Ala Asn Tyr Glu Glu Glu Ile Val Arg Pro
 1               5                  10                  15
Val Ala Asp Phe Ser Pro Ser Leu Trp Gly Asp Gln Phe Leu Ser Phe
            20              25                  30
Ser Ile Asp Asn Gln Val Ala Glu Lys Tyr Ala Gln Glu Ile Glu Ala
        35                  40                  45
Leu Lys Glu Gln Thr Arg Ser Met Leu Leu Ala Thr Gly Arg Lys Leu
    50                  55                  60
Ala Asp Thr Leu Asn Leu Ile Asp Ile Ile Glu Arg Leu Gly Ile Ser
65                  70                  75                  80
Tyr His Phe Glu Lys Glu Ile Asp Glu Ile Leu Asp Gln Ile Tyr Asn
                85                  90                  95
Gln Asn Ser Asn Cys Asn Asp Leu Cys Thr Ser Ala Leu Gln Phe Arg
            100                 105                 110
Leu Leu Arg Gln His Gly Phe Asn Ile Ser Pro Glu Ile Phe Ser Lys
        115                 120                 125
Phe Gln Asp Glu Asn Gly Lys Phe Lys Glu Ser Leu Ala Ser Asp Val
    130                 135                 140
Leu Gly Leu Leu Asn Leu Tyr Glu Ala Ser His Val Arg Thr His Ala
145                 150                 155                 160
Asp Asp Ile Leu Glu Asp Ala Leu Ala Phe Ser Thr Ile His Leu Glu
                165                 170                 175
Ser Ala Ala Pro His Leu Lys Ser Pro Leu Arg Glu Gln Val Thr His
            180                 185                 190
Ala Leu Glu Gln Cys Leu His Lys Gly Val Pro Arg Val Glu Thr Arg
        195                 200                 205
Phe Phe Ile Ser Ser Ile Tyr Asp Lys Glu Gln Ser Lys Asn Asn Val
    210                 215                 220
Leu Leu Arg Phe Ala Lys Leu Asp Phe Asn Leu Leu Gln Met Leu His
225                 230                 235                 240
Lys Gln Glu Leu Ala Gln Val Ser Arg Trp Trp Lys Asp Leu Asp Phe
                245                 250                 255
Val Thr Thr Leu Pro Tyr Ala Arg Asp Arg Val Val Glu Cys Tyr Phe
                260                 265                 270
```

```
Trp Ala Leu Gly Val Tyr Phe Glu Pro Gln Tyr Ser Gln Ala Arg Val
        275             280             285
Met Leu Val Lys Thr Ile Ser Met Ile Ser Ile Val Asp Asp Thr Phe
    290             295             300
Asp Ala Tyr Gly Thr Val Lys Glu Leu Glu Ala Tyr Thr Asp Ala Ile
305             310             315             320
Gln Arg Trp Asp Ile Asn Glu Ile Asp Arg Leu Pro Asp Tyr Met Lys
            325             330             335
Ile Ser Tyr Lys Ala Ile Leu Asp Leu Tyr Lys Asp Tyr Glu Lys Glu
            340             345             350
Leu Ser Ser Ala Gly Arg Ser His Ile Val Cys His Ala Ile Glu Arg
            355             360             365
Met Lys Glu Val Val Arg Asn Tyr Asn Val Glu Ser Thr Trp Phe Ile
    370             375             380
Glu Gly Tyr Met Pro Pro Val Ser Glu Tyr Leu Ser Asn Ala Leu Ala
385             390             395             400
Thr Thr Thr Tyr Tyr Xaa Xaa Ala Thr Thr Ser Tyr Leu Gly Met Lys
            405             410             415
Ser Ala Thr Glu Gln Asp Phe Glu Trp Leu Ser Lys Asn Pro Lys Ile
            420             425             430
Leu Glu Ala Ser Val Ile Ile Cys Arg Val Ile Asp Asp Thr Ala Thr
    435             440             445
Tyr Glu Val Glu Lys Ser Arg Gly Gln Ile Ala Thr Gly Ile Glu Cys
    450             455             460
Cys Met Arg Asp Tyr Gly Ile Ser Thr Lys Glu Ala Met Ala Lys Phe
465             470             475             480
Gln Asn Met Ala Glu Thr Ala Trp Lys Asp Ile Asn Glu Gly Leu Leu
            485             490             495
Arg Pro Thr Pro Val Ser Thr Glu Phe Leu Thr Pro Ile Leu Asn Leu
            500             505             510
Ala Arg Ile Val Glu Val Thr Tyr Ile His Asn Leu Asp Gly Tyr Thr
    515             520             525
His Pro Glu Lys Val Leu Lys Pro His Ile Ile Asn Leu Leu Val Asp
    530             535             540
Ser Ile Lys Ile
545
```

<210> 13
<211> 33
<212> DNA
<213> Artificial Sequence

<220>
<223> primer for mutagenesis

<400> 13
 gttgaatgct acttttcggc attaggagtt tat   33

<210> 14
<211> 33
<212> DNA
<213> Artificial Sequence

<220>
<223> primer for mutagenesis

<400> 14

```
ataaactcct aatgccgaaa agtagcattc aac                              33
```

```
<210> 15
<211> 33
<212> DNA
<213> Artificial Sequence

<220>
<223> primer for mutagenesis

<400> 15
 gctagtgtaa ttatatggcg agttatcgat gac                             33
```

```
<210> 16
<211> 33
<212> DNA
<213> Artificial Sequence

<220>
<223> primer for mutagenesis

<400> 16
 gtcatcgata actcgccata taattacact agc                             33
```

```
<210> 17
<211> 54
<212> DNA
<213> Artificial Sequence

<220>
<223> primer for mutagenesis

<221> misc_feature
<222> (1)...(54)
<223> n = A,T,C or G

<400> 17
 gcactagcaa ctaccacata ttacnnsnns gcgacaacat cgtatttggg catg      54
```

```
<210> 18
<211> 54
<212> DNA
<213> Artificial Sequence

<220>
<223> primer for mutagenesis

<221> misc_feature
<222> (1)...(54)
<223> n = A,T,C or G

<400> 18
 catgcccaaa tacgatgttg tcgcsnnsnn gtaatatgtg gtagttgcta gtgc      54
```

```
<210> 19
<211> 2018
<212> DNA
```

<213> Abies grandis

<220>
<221> CDS
<222> (6)...(1889)
<223> pinene synthase

<400> 19
```
 cagca atg gct cta gtt tct acc gca ccg ttg gct tcc aaa tca tgc ctg      50
       Met Ala Leu Val Ser Thr Ala Pro Leu Ala Ser Lys Ser Cys Leu
        1               5                  10                  15

 cac aaa tcg ttg atc agt tct acc cat gag ctt aag gct ctc tct aga      98
 His Lys Ser Leu Ile Ser Ser Thr His Glu Leu Lys Ala Leu Ser Arg
             20                  25                  30

 aca att cca gct cta gga atg agt agg cga ggg aaa tct atc act cct     146
 Thr Ile Pro Ala Leu Gly Met Ser Arg Arg Gly Lys Ser Ile Thr Pro
                 35                  40                  45

 tcc atc agc atg agc tct acc acc gtt gta acc gat gat ggt gta cga     194
 Ser Ile Ser Met Ser Ser Thr Thr Val Val Thr Asp Asp Gly Val Arg
             50                  55                  60

 aga cgc atg ggc gat ttc cat tcc aac ctc tgg gac gat gat gtc ata     242
 Arg Arg Met Gly Asp Phe His Ser Asn Leu Trp Asp Asp Asp Val Ile
         65                  70                  75

 cag tct tta cca acg gct tat gag gaa aaa tcg tac ctg gag cgt gct     290
 Gln Ser Leu Pro Thr Ala Tyr Glu Glu Lys Ser Tyr Leu Glu Arg Ala
    80                  85                  90                  95

 gag aaa ctg atc ggg gaa gta aag aac atg ttc aat tcg atg tca tta     338
 Glu Lys Leu Ile Gly Glu Val Lys Asn Met Phe Asn Ser Met Ser Leu
                 100                 105                 110

 gaa gat gga gag tta atg agt ccg ctc aat gat ctc att caa cgc ctt     386
 Glu Asp Gly Glu Leu Met Ser Pro Leu Asn Asp Leu Ile Gln Arg Leu
             115                 120                 125

 tgg att gtc gac agc ctt gaa cgt ttg ggg atc cat aga cat ttc aaa     434
 Trp Ile Val Asp Ser Leu Glu Arg Leu Gly Ile His Arg His Phe Lys
             130                 135                 140

 gat gag ata aaa tcg gcg ctt gat tat gtt tac agt tat tgg ggc gaa     482
 Asp Glu Ile Lys Ser Ala Leu Asp Tyr Val Tyr Ser Tyr Trp Gly Glu
             145                 150                 155

 aat ggc atc gga tgc ggg agg gag agt gtt gtt act gat ctg aac tca     530
 Asn Gly Ile Gly Cys Gly Arg Glu Ser Val Val Thr Asp Leu Asn Ser
 160                 165                 170                 175

 act gcg ttg ggg ctt cga acc cta cga cta cac gga tac ccg gtg tct     578
 Thr Ala Leu Gly Leu Arg Thr Leu Arg Leu His Gly Tyr Pro Val Ser
                 180                 185                 190

 tca gat gtt ttc aaa gct ttc aaa ggc caa aat ggg cag ttt tcc tgc     626
```

Ser Asp Val Phe Lys Ala Phe Lys Gly Gln Asn Gly Gln Phe Ser Cys
          195   200   205

tct gaa aat att cag aca gat gaa gag atc aga ggc gtt ctg aat tta   674
Ser Glu Asn Ile Gln Thr Asp Glu Glu Ile Arg Gly Val Leu Asn Leu
          210   215   220

ttc cgg gcc tcc ctc att gcc ttt cca ggg gag aaa att atg gat gag   722
Phe Arg Ala Ser Leu Ile Ala Phe Pro Gly Glu Lys Ile Met Asp Glu
          225   230   235

gct gaa atc ttc tct acc aaa tat tta aaa gaa gcc ctg caa aag att   770
Ala Glu Ile Phe Ser Thr Lys Tyr Leu Lys Glu Ala Leu Gln Lys Ile
240   245   250   255

ccg gtc tcc agt ctt tcg cga gag atc ggg gac gtt ttg gaa tat ggt   818
Pro Val Ser Ser Leu Ser Arg Glu Ile Gly Asp Val Leu Glu Tyr Gly
                  260   265   270

tgg cac aca tat ttg ccg cga ttg gaa gca agg aat tac atc caa gtc   866
Trp His Thr Tyr Leu Pro Arg Leu Glu Ala Arg Asn Tyr Ile Gln Val
              275   280   285

ttt gga cag gac act gag aac acg aag tca tat gtg aag agc aaa aaa   914
Phe Gly Gln Asp Thr Glu Asn Thr Lys Ser Tyr Val Lys Ser Lys Lys
          290   295   300

ctt tta gaa ctc gca aaa ttg gag ttc aac atc ttt caa tcc tta caa   962
Leu Leu Glu Leu Ala Lys Leu Glu Phe Asn Ile Phe Gln Ser Leu Gln
          305   310   315

aag agg gag tta gaa agt ctg gtc aga tgg tgg aaa gaa tcg ggt ttt   1010
Lys Arg Glu Leu Glu Ser Leu Val Arg Trp Trp Lys Glu Ser Gly Phe
320   325   330   335

cct gag atg acc ttc tgc cga cat cgt cac gtg gaa tac tac act ttg   1058
Pro Glu Met Thr Phe Cys Arg His Arg His Val Glu Tyr Tyr Thr Leu
              340   345   350

gct tcc tgc att gcg ttc gag cct caa cat tct gga ttc aga ctc ggc   1106
Ala Ser Cys Ile Ala Phe Glu Pro Gln His Ser Gly Phe Arg Leu Gly
              355   360   365

ttt gcc aag acg tgt cat ctt atc acg gtt ctt gac gat atg tac gac   1154
Phe Ala Lys Thr Cys His Leu Ile Thr Val Leu Asp Asp Met Tyr Asp
          370   375   380

acc ttc ggc aca gta gac gag ctg gaa ctc ttc aca gcg aca atg aag   1202
Thr Phe Gly Thr Val Asp Glu Leu Glu Leu Phe Thr Ala Thr Met Lys
          385   390   395

aga tgg gat ccg tcc tcg ata gat tgc ctt cca gaa tat atg aaa gga   1250
Arg Trp Asp Pro Ser Ser Ile Asp Cys Leu Pro Glu Tyr Met Lys Gly
400   405   410   415

gtg tac ata gcg gtt tac gac acc gta aat gaa atg gct cga gag gca   1298
Val Tyr Ile Ala Val Tyr Asp Thr Val Asn Glu Met Ala Arg Glu Ala

```
              420                    425                    430
gag gag gct caa ggc cga gat acg ctc aca tat gct cgg gaa gct tgg    1346
Glu Glu Ala Gln Gly Arg Asp Thr Leu Thr Tyr Ala Arg Glu Ala Trp
            435                    440                    445

gag gct tat att gat tcg tat atg caa gaa gca agg tgg atc gcc act    1394
Glu Ala Tyr Ile Asp Ser Tyr Met Gln Glu Ala Arg Trp Ile Ala Thr
            450                    455                    460

ggt tac ctg ccc tcc ttt gat gag tac tac gag aat ggg aaa gtt agc    1442
Gly Tyr Leu Pro Ser Phe Asp Glu Tyr Tyr Glu Asn Gly Lys Val Ser
            465                    470                    475

tgt ggt cat cgc ata tcc gca ttg caa ccc att ctg aca atg gac atc    1490
Cys Gly His Arg Ile Ser Ala Leu Gln Pro Ile Leu Thr Met Asp Ile
480                    485                    490                    495

ccc ttt cct gat cat atc ctc aag gaa gtt gac ttc cca tca aag ctt    1538
Pro Phe Pro Asp His Ile Leu Lys Glu Val Asp Phe Pro Ser Lys Leu
                500                    505                    510

aac gac ttg gca tgt gcc atc ctt cga tta cga ggt gat acg cgg tgc    1586
Asn Asp Leu Ala Cys Ala Ile Leu Arg Leu Arg Gly Asp Thr Arg Cys
                515                    520                    525

tac aag gcg gac agg gct cgt gga gaa gaa gct tcc tct ata tca tgt    1634
Tyr Lys Ala Asp Arg Ala Arg Gly Glu Glu Ala Ser Ser Ile Ser Cys
            530                    535                    540

tat atg aaa gac aat cct gga gta tca gag gaa gat gct ctc gat cat    1682
Tyr Met Lys Asp Asn Pro Gly Val Ser Glu Glu Asp Ala Leu Asp His
            545                    550                    555

atc aac gcc atg atc agt gac gta atc aaa gga tta aat tgg gaa ctt    1730
Ile Asn Ala Met Ile Ser Asp Val Ile Lys Gly Leu Asn Trp Glu Leu
560                    565                    570                    575

ctc aaa cca gac atc aat gtt ccc atc tcg gcg aag aaa cat gct ttt    1778
Leu Lys Pro Asp Ile Asn Val Pro Ile Ser Ala Lys Lys His Ala Phe
                580                    585                    590

gac atc gcc aga gct ttc cat tac ggc tac aaa tac cga gac ggc tac    1826
Asp Ile Ala Arg Ala Phe His Tyr Gly Tyr Lys Tyr Arg Asp Gly Tyr
            595                    600                    605

agc gtt gcc aac gtt gaa acg aag agt ttg gtc acg aga acc ctc ctt    1874
Ser Val Ala Asn Val Glu Thr Lys Ser Leu Val Thr Arg Thr Leu Leu
            610                    615                    620

gaa tct gtg cct ttg tag caacagctca aatctatgcc ctatgctatg    1922
Glu Ser Val Pro Leu
            625

tcgggttaaa atatatgtgg aaggtagccg ttggatgtag aggataagtt tgttataatt    1982
taataaagtt gtaatttaaa aaaaaaaaaa aaaaaa    2018
```

<210> 20
<211> 628
<212> PRT
<213> Abies grandis

<400> 20
Met Ala Leu Val Ser Thr Ala Pro Leu Ala Ser Lys Ser Cys Leu His
1   5   10   15
Lys Ser Leu Ile Ser Ser Thr His Glu Leu Lys Ala Leu Ser Arg Thr
            20   25   30
Ile Pro Ala Leu Gly Met Ser Arg Arg Gly Lys Ser Ile Thr Pro Ser
            35   40   45
Ile Ser Met Ser Ser Thr Thr Val Val Thr Asp Asp Gly Val Arg Arg
        50   55   60
Arg Met Gly Asp Phe His Ser Asn Leu Trp Asp Asp Asp Val Ile Gln
65   70   75   80
Ser Leu Pro Thr Ala Tyr Glu Glu Lys Ser Tyr Leu Glu Arg Ala Glu
                85   90   95
Lys Leu Ile Gly Glu Val Lys Asn Met Phe Asn Ser Met Ser Leu Glu
            100   105   110
Asp Gly Glu Leu Met Ser Pro Leu Asn Asp Leu Ile Gln Arg Leu Trp
            115   120   125
Ile Val Asp Ser Leu Glu Arg Leu Gly Ile His Arg His Phe Lys Asp
        130   135   140
Glu Ile Lys Ser Ala Leu Asp Tyr Val Tyr Ser Tyr Trp Gly Glu Asn
145   150   155   160
Gly Ile Gly Cys Gly Arg Glu Ser Val Val Thr Asp Leu Asn Ser Thr
                165   170   175
Ala Leu Gly Leu Arg Thr Leu Arg Leu His Gly Tyr Pro Val Ser Ser
            180   185   190
Asp Val Phe Lys Ala Phe Lys Gly Gln Asn Gly Gln Phe Ser Cys Ser
        195   200   205
Glu Asn Ile Gln Thr Asp Glu Glu Ile Arg Gly Val Leu Asn Leu Phe
        210   215   220
Arg Ala Ser Leu Ile Ala Phe Pro Gly Glu Lys Ile Met Asp Glu Ala
225   230   235   240
Glu Ile Phe Ser Thr Lys Tyr Leu Lys Glu Ala Leu Gln Lys Ile Pro
                245   250   255
Val Ser Ser Leu Ser Arg Glu Ile Gly Asp Val Leu Glu Tyr Gly Trp
            260   265   270
His Thr Tyr Leu Pro Arg Leu Glu Ala Arg Asn Tyr Ile Gln Val Phe
            275   280   285
Gly Gln Asp Thr Glu Asn Thr Lys Ser Tyr Val Lys Ser Lys Lys Leu
        290   295   300
Leu Glu Leu Ala Lys Leu Glu Phe Asn Ile Phe Gln Ser Leu Gln Lys
305   310   315   320
Arg Glu Leu Glu Ser Leu Val Arg Trp Trp Lys Glu Ser Gly Phe Pro
            325   330   335
Glu Met Thr Phe Cys Arg His Arg His Val Glu Tyr Tyr Thr Leu Ala
            340   345   350
Ser Cys Ile Ala Phe Glu Pro Gln His Ser Gly Phe Arg Leu Gly Phe
        355   360   365
Ala Lys Thr Cys His Leu Ile Thr Val Leu Asp Asp Met Tyr Asp Thr
        370   375   380
Phe Gly Thr Val Asp Glu Leu Glu Leu Phe Thr Ala Thr Met Lys Arg
385   390   395   400
Trp Asp Pro Ser Ser Ile Asp Cys Leu Pro Glu Tyr Met Lys Gly Val

```
                    405                      410                      415
Tyr Ile Ala Val Tyr Asp Thr Val Asn Glu Met Ala Arg Glu Ala Glu
                420                      425                      430
Glu Ala Gln Gly Arg Asp Thr Leu Thr Tyr Ala Arg Glu Ala Trp Glu
            435                      440                      445
Ala Tyr Ile Asp Ser Tyr Met Gln Glu Ala Arg Trp Ile Ala Thr Gly
        450                      455                      460
Tyr Leu Pro Ser Phe Asp Glu Tyr Tyr Glu Asn Gly Lys Val Ser Cys
465                      470                      475                      480
Gly His Arg Ile Ser Ala Leu Gln Pro Ile Leu Thr Met Asp Ile Pro
                485                      490                      495
Phe Pro Asp His Ile Leu Lys Glu Val Asp Phe Pro Ser Lys Leu Asn
                500                      505                      510
Asp Leu Ala Cys Ala Ile Leu Arg Leu Arg Gly Asp Thr Arg Cys Tyr
            515                      520                      525
Lys Ala Asp Arg Ala Arg Gly Glu Glu Ala Ser Ser Ile Ser Cys Tyr
        530                      535                      540
Met Lys Asp Asn Pro Gly Val Ser Glu Glu Asp Ala Leu Asp His Ile
545                      550                      555                      560
Asn Ala Met Ile Ser Asp Val Ile Lys Gly Leu Asn Trp Glu Leu Leu
                565                      570                      575
Lys Pro Asp Ile Asn Val Pro Ile Ser Ala Lys Lys His Ala Phe Asp
                580                      585                      590
Ile Ala Arg Ala Phe His Tyr Gly Tyr Lys Tyr Arg Asp Gly Tyr Ser
            595                      600                      605
Val Ala Asn Val Glu Thr Lys Ser Leu Val Thr Arg Thr Leu Leu Glu
        610                      615                      620
Ser Val Pro Leu
625
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<210> 21
<211> 2170
<212> DNA
<213> Mentha spicata

<220>
<221> CDS
<222> (29)...(1825)
<223> 4S-limonene synthase

<400> 21
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   agagagagag aggaaggaaa gattaatc atg gct ctc aaa gtg tta agt gtt          52
                                    Met Ala Leu Lys Val Leu Ser Val
                                     1               5

   gca act caa atg gcg att cct agc aac cta acg aca tgt ctt caa ccc         100
   Ala Thr Gln Met Ala Ile Pro Ser Asn Leu Thr Thr Cys Leu Gln Pro
       10                  15                  20

   tca cac ttc aaa tct tct cca aaa ctg tta tct agc act aac agt agt         148
   Ser His Phe Lys Ser Ser Pro Lys Leu Leu Ser Ser Thr Asn Ser Ser
    25                  30                  35                  40

   agt cgg tct cgc ctc cgt gtg tat tgc tcc tcc tcg caa ctc act act         196
   Ser Arg Ser Arg Leu Arg Val Tyr Cys Ser Ser Ser Gln Leu Thr Thr
                    45                  50                  55
```

```
gaa aga cga tcc gga aac tac aac cct tct cgt tgg gat gtc aac ttc        244
Glu Arg Arg Ser Gly Asn Tyr Asn Pro Ser Arg Trp Asp Val Asn Phe
            60                  65                  70

atc caa tcg ctt ctc agt gac tat aag gag gac aaa cac gtg att agg        292
Ile Gln Ser Leu Leu Ser Asp Tyr Lys Glu Asp Lys His Val Ile Arg
        75                  80                  85

gct tct gag ctg gtc act ttg gtg aag atg gaa ctg gag aaa gaa acg        340
Ala Ser Glu Leu Val Thr Leu Val Lys Met Glu Leu Glu Lys Glu Thr
        90                  95                  100

gat caa att cga caa ctt gag ttg atc gat gac ttg cag agg atg ggg        388
Asp Gln Ile Arg Gln Leu Glu Leu Ile Asp Asp Leu Gln Arg Met Gly
105                 110                 115                 120

ctg tcc gat cat ttc caa aat gag ttc aaa gaa atc ttg tcc tct ata        436
Leu Ser Asp His Phe Gln Asn Glu Phe Lys Glu Ile Leu Ser Ser Ile
                125                 130                 135

tat ctc gac cat cac tat tac aag aac cct ttt cca aaa gaa gaa agg        484
Tyr Leu Asp His His Tyr Tyr Lys Asn Pro Phe Pro Lys Glu Glu Arg
                140                 145                 150

gat ctc tac tcc aca tct ctt gca ttt agg ctc ctc aga gaa cat ggt        532
Asp Leu Tyr Ser Thr Ser Leu Ala Phe Arg Leu Leu Arg Glu His Gly
            155                 160                 165

ttt caa gtc gca caa gag gta ttc gat agt ttc aag aac gag gag ggt        580
Phe Gln Val Ala Gln Glu Val Phe Asp Ser Phe Lys Asn Glu Glu Gly
        170                 175                 180

gag ttc aaa gaa agc ctt agc gac gac acc aga gga ttg ttg caa ctg        628
Glu Phe Lys Glu Ser Leu Ser Asp Asp Thr Arg Gly Leu Leu Gln Leu
185                 190                 195                 200

tat gaa gct tcc ttt ctg ttg acg gaa ggc gaa acc acg ctc gag tca        676
Tyr Glu Ala Ser Phe Leu Leu Thr Glu Gly Glu Thr Thr Leu Glu Ser
                205                 210                 215

gcg agg gaa ttc gcc acc aaa ttt ttg gag gaa aaa gtg aac gag ggt        724
Ala Arg Glu Phe Ala Thr Lys Phe Leu Glu Glu Lys Val Asn Glu Gly
            220                 225                 230

ggt gtt gat ggc gac ctt tta aca aga atc gca tat tct ttg gac atc        772
Gly Val Asp Gly Asp Leu Leu Thr Arg Ile Ala Tyr Ser Leu Asp Ile
            235                 240                 245

cct ctt cat tgg agg att aaa agg cca aat gca cct gtg tgg atc gaa        820
Pro Leu His Trp Arg Ile Lys Arg Pro Asn Ala Pro Val Trp Ile Glu
        250                 255                 260

tgg tat agg aag agg ccc gac atg aat cca gta gtg ttg gag ctt gcc        868
Trp Tyr Arg Lys Arg Pro Asp Met Asn Pro Val Val Leu Glu Leu Ala
265                 270                 275                 280

ata ctc gac tta aat att gtt caa gca caa ttt caa gaa gag ctc aaa        916
```

```
Ile Leu Asp Leu Asn Ile Val Gln Ala Gln Phe Gln Glu Glu Leu Lys
            285             290             295
```

```
gaa tcc ttc agg tgg tgg aga aat act ggg ttt gtt gag aag ctg ccc        964
Glu Ser Phe Arg Trp Trp Arg Asn Thr Gly Phe Val Glu Lys Leu Pro
            300             305             310
```

```
ttc gca agg gat aga ctg gtg gaa tgc tac ttt tgg aat act ggg atc       1012
Phe Ala Arg Asp Arg Leu Val Glu Cys Tyr Phe Trp Asn Thr Gly Ile
            315             320             325
```

```
atc gag cca cgt cag cat gca agt gca agg ata atg atg ggc aaa gtc       1060
Ile Glu Pro Arg Gln His Ala Ser Ala Arg Ile Met Met Gly Lys Val
            330             335             340
```

```
aac gct ctg att acg gtg atc gat gat att tat gat gtc tat ggc acc       1108
Asn Ala Leu Ile Thr Val Ile Asp Asp Ile Tyr Asp Val Tyr Gly Thr
345             350             355             360
```

```
tta gaa gaa ctc gaa caa ttc act gac ctc att cga aga tgg gat ata       1156
Leu Glu Glu Leu Glu Gln Phe Thr Asp Leu Ile Arg Arg Trp Asp Ile
            365             370             375
```

```
aac tca atc gac caa ctt ccc gat tac atg caa ctg tgc ttt ctt gca       1204
Asn Ser Ile Asp Gln Leu Pro Asp Tyr Met Gln Leu Cys Phe Leu Ala
            380             385             390
```

```
ctc aac aac ttc gtc gat gat aca tcg tac gat gtt atg aag gag aaa       1252
Leu Asn Asn Phe Val Asp Asp Thr Ser Tyr Asp Val Met Lys Glu Lys
            395             400             405
```

```
ggc gtc aac gtt ata ccc tac ctg cgg caa tcg tgg gtt gat ttg gcg       1300
Gly Val Asn Val Ile Pro Tyr Leu Arg Gln Ser Trp Val Asp Leu Ala
            410             415             420
```

```
gat aag tat atg gta gag gca cgg tgg ttc tac ggc ggg cac aaa cca       1348
Asp Lys Tyr Met Val Glu Ala Arg Trp Phe Tyr Gly Gly His Lys Pro
425             430             435             440
```

```
agt ttg gaa gag tat ttg gag aac tca tgg cag tcg ata agt ggg ccc       1396
Ser Leu Glu Glu Tyr Leu Glu Asn Ser Trp Gln Ser Ile Ser Gly Pro
            445             450             455
```

```
tgt atg tta acg cac ata ttc ttc cga gta aca gat tcg ttc aca aag       1444
Cys Met Leu Thr His Ile Phe Phe Arg Val Thr Asp Ser Phe Thr Lys
            460             465             470
```

```
gag acc gtc gac agt ttg tac aaa tac cac gat tta gtt cgt tgg tca       1492
Glu Thr Val Asp Ser Leu Tyr Lys Tyr His Asp Leu Val Arg Trp Ser
            475             480             485
```

```
tcc ttc gtt ctg cgg ctt gct gat gat ttg gga acc tcg gtg gaa gag       1540
Ser Phe Val Leu Arg Leu Ala Asp Asp Leu Gly Thr Ser Val Glu Glu
            490             495             500
```

```
gtg agc aga ggg gat gtg ccg aaa tca ctt cag tgc tac atg agt gac       1588
Val Ser Arg Gly Asp Val Pro Lys Ser Leu Gln Cys Tyr Met Ser Asp
```

```
              505                  510                  515                  520

tac aat gca tcg gag gcg gag gcg cgg aag cac gtg aaa tgg ctg ata      1636
Tyr Asn Ala Ser Glu Ala Glu Ala Arg Lys His Val Lys Trp Leu Ile
                    525                  530                  535

gcg gag gtg tgg aag aag atg aat gcg gag agg gtg tcg aag gat tct      1684
Ala Glu Val Trp Lys Lys Met Asn Ala Glu Arg Val Ser Lys Asp Ser
                    540                  545                  550

cca ttc ggc aaa gat ttt ata gga tgt gca gtt gat tta gga agg atg      1732
Pro Phe Gly Lys Asp Phe Ile Gly Cys Ala Val Asp Leu Gly Arg Met
                    555                  560                  565

gcg cag ttg atg tac cat aat gga gat ggg cac ggc aca caa cac cct      1780
Ala Gln Leu Met Tyr His Asn Gly Asp Gly His Gly Thr Gln His Pro
        570                  575                  580

att ata cat caa caa atg acc aga acc tta ttc gag ccc ttt gca tga      1828
Ile Ile His Gln Gln Met Thr Arg Thr Leu Phe Glu Pro Phe Ala
585                  590                  595

gagatgatga cgagccatcg tttacttact taaattctac caaagttttt cgaaggcata    1888
gttcgtaatt tttcaagcac caataaataa ggagaatcgg ctcaaacaaa cgtggcattt    1948
gccaccacgt gagcacaagg gagagtctgt cgtcgtttat ggatgaacta ttcaattttt    2008
atgcatgtaa taattaagtt caagttcaag agccttctgc atatttaact atgtatttga    2068
atttatcgag tgtgattttc tgtctttggc aacatatatt tttgtcatat gtggcatctt    2128
attatgatat catacagtgt ttatggatga tatgatacta tc                       2170
```

<210> 22
<211> 599
<212> PRT
<213> Mentha spicata

<400> 22
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Met Ala Leu Lys Val Leu Ser Val Ala Thr Gln Met Ala Ile Pro Ser
1               5                   10                  15
Asn Leu Thr Thr Cys Leu Gln Pro Ser His Phe Lys Ser Ser Pro Lys
            20                  25                  30
Leu Leu Ser Ser Thr Asn Ser Ser Ser Arg Ser Arg Leu Arg Val Tyr
        35                  40                  45
Cys Ser Ser Ser Gln Leu Thr Thr Glu Arg Arg Ser Gly Asn Tyr Asn
    50                  55                  60
Pro Ser Arg Trp Asp Val Asn Phe Ile Gln Ser Leu Leu Ser Asp Tyr
65                  70                  75                  80
Lys Glu Asp Lys His Val Ile Arg Ala Ser Glu Leu Val Thr Leu Val
                85                  90                  95
Lys Met Glu Leu Glu Lys Glu Thr Asp Gln Ile Arg Gln Leu Glu Leu
            100                 105                 110
Ile Asp Asp Leu Gln Arg Met Gly Leu Ser Asp His Phe Gln Asn Glu
        115                 120                 125
Phe Lys Glu Ile Leu Ser Ser Ile Tyr Leu Asp His His Tyr Tyr Lys
    130                 135                 140
Asn Pro Phe Pro Lys Glu Glu Arg Asp Leu Tyr Ser Thr Ser Leu Ala
145                 150                 155                 160
Phe Arg Leu Leu Arg Glu His Gly Phe Gln Val Ala Gln Glu Val Phe
                165                 170                 175
```

```
Asp Ser Phe Lys Asn Glu Glu Gly Glu Phe Lys Glu Ser Leu Ser Asp
            180               185           190
Asp Thr Arg Gly Leu Leu Gln Leu Tyr Glu Ala Ser Phe Leu Leu Thr
        195               200           205
Glu Gly Glu Thr Thr Leu Glu Ser Ala Arg Glu Phe Ala Thr Lys Phe
    210               215           220
Leu Glu Glu Lys Val Asn Glu Gly Gly Val Asp Gly Asp Leu Leu Thr
225               230           235               240
Arg Ile Ala Tyr Ser Leu Asp Ile Pro Leu His Trp Arg Ile Lys Arg
            245           250           255
Pro Asn Ala Pro Val Trp Ile Glu Trp Tyr Arg Lys Arg Pro Asp Met
            260           265           270
Asn Pro Val Val Leu Glu Leu Ala Ile Leu Asp Leu Asn Ile Val Gln
        275           280           285
Ala Gln Phe Gln Glu Glu Leu Lys Glu Ser Phe Arg Trp Trp Arg Asn
    290               295           300
Thr Gly Phe Val Glu Lys Leu Pro Phe Ala Arg Asp Arg Leu Val Glu
305               310           315               320
Cys Tyr Phe Trp Asn Thr Gly Ile Ile Glu Pro Arg Gln His Ala Ser
            325           330           335
Ala Arg Ile Met Met Gly Lys Val Asn Ala Leu Ile Thr Val Ile Asp
            340           345           350
Asp Ile Tyr Asp Val Tyr Gly Thr Leu Glu Glu Leu Glu Gln Phe Thr
        355           360           365
Asp Leu Ile Arg Arg Trp Asp Ile Asn Ser Ile Asp Gln Leu Pro Asp
        370           375           380
Tyr Met Gln Leu Cys Phe Leu Ala Leu Asn Asn Phe Val Asp Asp Thr
385           390           395               400
Ser Tyr Asp Val Met Lys Glu Lys Gly Val Asn Val Ile Pro Tyr Leu
            405           410           415
Arg Gln Ser Trp Val Asp Leu Ala Asp Lys Tyr Met Val Glu Ala Arg
            420           425           430
Trp Phe Tyr Gly Gly His Lys Pro Ser Leu Glu Glu Tyr Leu Glu Asn
            435           440           445
Ser Trp Gln Ser Ile Ser Gly Pro Cys Met Leu Thr His Ile Phe Phe
    450               455           460
Arg Val Thr Asp Ser Phe Thr Lys Glu Thr Val Asp Ser Leu Tyr Lys
465               470           475               480
Tyr His Asp Leu Val Arg Trp Ser Ser Phe Val Leu Arg Leu Ala Asp
            485           490           495
Asp Leu Gly Thr Ser Val Glu Glu Val Ser Arg Gly Asp Val Pro Lys
            500           505           510
Ser Leu Gln Cys Tyr Met Ser Asp Tyr Asn Ala Ser Glu Ala Glu Ala
        515               520           525
Arg Lys His Val Lys Trp Leu Ile Ala Glu Val Trp Lys Lys Met Asn
    530               535           540
Ala Glu Arg Val Ser Lys Asp Ser Pro Phe Gly Lys Asp Phe Ile Gly
545               550           555               560
Cys Ala Val Asp Leu Gly Arg Met Ala Gln Leu Met Tyr His Asn Gly
            565           570           575
Asp Gly His Gly Thr Gln His Pro Ile Ile His Gln Gln Met Thr Arg
            580           585           590
Thr Leu Phe Glu Pro Phe Ala
            595
```

<210> 23
<211> 1967

<212> DNA
<213> Salvia officinalis

<220>
<221> CDS
<222> (13)...(1785)
<223> 1,8-cineole synthase

<400> 23

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 gatcaccaca ag atg tcg agt ctt ata atg caa gtt gtt att cct aag cca      51
               Met Ser Ser Leu Ile Met Gln Val Val Ile Pro Lys Pro
                1               5                  10

 gcc aaa att ttt cac aat aac tta ttc agc gtg att tca aaa cga cat        99
 Ala Lys Ile Phe His Asn Asn Leu Phe Ser Val Ile Ser Lys Arg His
     15              20                  25

 cgt ttc agt act aca atc acc act cgt ggt ggc agg tgg gca cat tgc       147
 Arg Phe Ser Thr Thr Ile Thr Thr Arg Gly Gly Arg Trp Ala His Cys
 30                  35                  40                  45

 tca cta caa atg ggt aat gag atc caa act gga cga cga act gga ggc       195
 Ser Leu Gln Met Gly Asn Glu Ile Gln Thr Gly Arg Arg Thr Gly Gly
                 50                  55                  60

 tac cag cct acc ctt tgg gat ttc agc acc att caa ttg ttc gac tct       243
 Tyr Gln Pro Thr Leu Trp Asp Phe Ser Thr Ile Gln Leu Phe Asp Ser
             65                  70                  75

 gag tat aag gaa gag aag cac ttg atg agg gcc gca ggt atg ata gcc       291
 Glu Tyr Lys Glu Glu Lys His Leu Met Arg Ala Ala Gly Met Ile Ala
             80                  85                  90

 caa gtg aat atg ttg ttg cag gaa gaa gta gat tcg att caa cgg ttg       339
 Gln Val Asn Met Leu Leu Gln Glu Glu Val Asp Ser Ile Gln Arg Leu
     95                  100                 105

 gag ttg att gat gac cta cga agg ctg ggt ata tct tgc cat ttt gac       387
 Glu Leu Ile Asp Asp Leu Arg Arg Leu Gly Ile Ser Cys His Phe Asp
 110                 115                 120                 125

 cgc gag atc gtt gaa ata tta aac tca aaa tat tat acc aac aat gag       435
 Arg Glu Ile Val Glu Ile Leu Asn Ser Lys Tyr Tyr Thr Asn Asn Glu
                 130                 135                 140

 ata gat gaa agt gat cta tac tca aca gcc ctt aga ttc aag ctc cta       483
 Ile Asp Glu Ser Asp Leu Tyr Ser Thr Ala Leu Arg Phe Lys Leu Leu
                 145                 150                 155

 aga caa tac gat ttt agc gtc tct caa gag gta ttt gat tgt ttc aag       531
 Arg Gln Tyr Asp Phe Ser Val Ser Gln Glu Val Phe Asp Cys Phe Lys
             160                 165                 170

 aat gac aag ggt act gat ttc aag cca agc cta gtc gat gat act aga       579
 Asn Asp Lys Gly Thr Asp Phe Lys Pro Ser Leu Val Asp Asp Thr Arg
     175                 180                 185
```

gga ttg tta caa ttg tac gaa gct tcg ttt tta tca gca caa ggc gaa   627
Gly Leu Leu Gln Leu Tyr Glu Ala Ser Phe Leu Ser Ala Gln Gly Glu
190   195   200   205

gaa acc cta cat ctt gcc aga gat ttt gct act aaa ttt ctg cat aaa   675
Glu Thr Leu His Leu Ala Arg Asp Phe Ala Thr Lys Phe Leu His Lys
                    210   215   220

aga gta cta gtt gat aaa gac att aat ctc tta tca tca att gaa cgt   723
Arg Val Leu Val Asp Lys Asp Ile Asn Leu Leu Ser Ser Ile Glu Arg
                225   230   235

gcg ttg gag ttg cct act cat tgg agg gtt caa atg ccc aac gca aga   771
Ala Leu Glu Leu Pro Thr His Trp Arg Val Gln Met Pro Asn Ala Arg
            240   245   250

tcc ttc att gat gct tat aag agg aga ccc gac atg aat ccg act gtg   819
Ser Phe Ile Asp Ala Tyr Lys Arg Arg Pro Asp Met Asn Pro Thr Val
        255   260   265

cta gaa cta gct aaa ttg gac ttc aat atg gtt caa gca caa ttt caa   867
Leu Glu Leu Ala Lys Leu Asp Phe Asn Met Val Gln Ala Gln Phe Gln
270   275   280   285

caa gag ctc aaa gag gcc tct agg tgg tgg aat agt acg ggt ctt gtc   915
Gln Glu Leu Lys Glu Ala Ser Arg Trp Trp Asn Ser Thr Gly Leu Val
                290   295   300

cac gag ctt ccc ttt gtg aga gat agg att gtg gaa tgc tac tac tgg   963
His Glu Leu Pro Phe Val Arg Asp Arg Ile Val Glu Cys Tyr Tyr Trp
                305   310   315

acg aca gga gtg gtt gag cgt cgt gaa cat gga tac gag agg ata atg   1011
Thr Thr Gly Val Val Glu Arg Arg Glu His Gly Tyr Glu Arg Ile Met
                320   325   330

ctc acc aaa ata aat gct ctt gtt aca aca ata gac gat gtc ttt gat   1059
Leu Thr Lys Ile Asn Ala Leu Val Thr Thr Ile Asp Asp Val Phe Asp
335   340   345

att tat ggt acg ctt gaa gag cta caa cta ttc aca act gct att caa   1107
Ile Tyr Gly Thr Leu Glu Glu Leu Gln Leu Phe Thr Thr Ala Ile Gln
350   355   360   365

aga tgg gat att gaa tca atg aag caa ctc cct cct tac atg caa ata   1155
Arg Trp Asp Ile Glu Ser Met Lys Gln Leu Pro Pro Tyr Met Gln Ile
                370   375   380

tgt tat ctt gct ctc ttc aac ttt gtg aat gag atg gct tat gat act   1203
Cys Tyr Leu Ala Leu Phe Asn Phe Val Asn Glu Met Ala Tyr Asp Thr
                385   390   395

ctt agg gat aaa ggt ttc aac tcc acc cca tat cta cga aaa gcg tgg   1251
Leu Arg Asp Lys Gly Phe Asn Ser Thr Pro Tyr Leu Arg Lys Ala Trp
                400   405   410

gtt gat ttg gtt gag tca tat cta ata gag gca aag tgg tac tac atg   1299

```
Val Asp Leu Val Glu Ser Tyr Leu Ile Glu Ala Lys Trp Tyr Tyr Met
415                 420             425

gga cat aaa cct agt ttg gaa gaa tat atg aag aat agt tgg ata tca      1347
Gly His Lys Pro Ser Leu Glu Glu Tyr Met Lys Asn Ser Trp Ile Ser
430                 435             440                 445

atc gga ggc atc ccc att cta tct cat cta ttt ttc cgg cta aca gat      1395
Ile Gly Gly Ile Pro Ile Leu Ser His Leu Phe Phe Arg Leu Thr Asp
                    450             455                 460

tcg att gag gaa gag gat gct gag agt atg cat aaa tac cat gat att      1443
Ser Ile Glu Glu Glu Asp Ala Glu Ser Met His Lys Tyr His Asp Ile
                465             470                 475

gtt cgt gca tcg tgt act att cta agg ctt gct gat gat atg gga aca      1491
Val Arg Ala Ser Cys Thr Ile Leu Arg Leu Ala Asp Asp Met Gly Thr
            480             485                 490

tcg ctg gat gag gtg gag aga ggc gac gtg ccc aaa tca gtt cag tgc      1539
Ser Leu Asp Glu Val Glu Arg Gly Asp Val Pro Lys Ser Val Gln Cys
        495             500                 505

tac atg aat gag aag aat gct tcg gaa gaa gaa gcg cga gag cat gtg      1587
Tyr Met Asn Glu Lys Asn Ala Ser Glu Glu Glu Ala Arg Glu His Val
510                 515             520                 525

cga tca ctc ata gac caa aca tgg aag atg atg aac aag gaa atg atg      1635
Arg Ser Leu Ile Asp Gln Thr Trp Lys Met Met Asn Lys Glu Met Met
                530             535                 540

acg tca tca ttt tcc aaa tat ttt gta caa gtt tct gct aat ctt gca      1683
Thr Ser Ser Phe Ser Lys Tyr Phe Val Gln Val Ser Ala Asn Leu Ala
                545             550                 555

aga atg gcg caa tgg ata tac cag cat gaa tct gat gga ttt ggc atg      1731
Arg Met Ala Gln Trp Ile Tyr Gln His Glu Ser Asp Gly Phe Gly Met
                560             565                 570

caa cat tca ttg gtg aac aaa atg ctc aga ggg ttg ttg ttc gac cgc      1779
Gln His Ser Leu Val Asn Lys Met Leu Arg Gly Leu Leu Phe Asp Arg
        575             580                 585

tat gag taa ctaatcttcg cccgggttcc aaatgaatca atctgttgtg            1828
Tyr Glu
590

ttgctgttcc acctgatatc aataataatt agacaaatgt ttctgtacgg gtggcccaac   1888
cgtcaggccc atttcgctca tgttcataat aaataataaa actgttaatc aataacaaaa   1948
aaaaaaaaaa aaaaaaaaa                                                1967
```

<210> 24
<211> 591
<212> PRT
<213> Salvia officinalis

<400> 24

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Met Ser Ser Leu Ile Met Gln Val Val Ile Pro Lys Pro Ala Lys Ile
 1           5                   10              15
Phe His Asn Asn Leu Phe Ser Val Ile Ser Lys Arg His Arg Phe Ser
            20              25              30
Thr Thr Ile Thr Thr Arg Gly Gly Arg Trp Ala His Cys Ser Leu Gln
        35              40              45
Met Gly Asn Glu Ile Gln Thr Gly Arg Arg Thr Gly Gly Tyr Gln Pro
    50              55              60
Thr Leu Trp Asp Phe Ser Thr Ile Gln Leu Phe Asp Ser Glu Tyr Lys
65              70              75              80
Glu Glu Lys His Leu Met Arg Ala Ala Gly Met Ile Ala Gln Val Asn
            85              90              95
Met Leu Leu Gln Glu Glu Val Asp Ser Ile Gln Arg Leu Glu Leu Ile
            100             105             110
Asp Asp Leu Arg Arg Leu Gly Ile Ser Cys His Phe Asp Arg Glu Ile
            115             120             125
Val Glu Ile Leu Asn Ser Lys Tyr Tyr Thr Asn Asn Glu Ile Asp Glu
    130             135             140
Ser Asp Leu Tyr Ser Thr Ala Leu Arg Phe Lys Leu Leu Arg Gln Tyr
145             150             155             160
Asp Phe Ser Val Ser Gln Glu Val Phe Asp Cys Phe Lys Asn Asp Lys
            165             170             175
Gly Thr Asp Phe Lys Pro Ser Leu Val Asp Asp Thr Arg Gly Leu Leu
            180             185             190
Gln Leu Tyr Glu Ala Ser Phe Leu Ser Ala Gln Gly Glu Glu Thr Leu
            195             200             205
His Leu Ala Arg Asp Phe Ala Thr Lys Phe Leu His Lys Arg Val Leu
            210             215             220
Val Asp Lys Asp Ile Asn Leu Leu Ser Ser Ile Glu Arg Ala Leu Glu
225             230             235             240
Leu Pro Thr His Trp Arg Val Gln Met Pro Asn Ala Arg Ser Phe Ile
            245             250             255
Asp Ala Tyr Lys Arg Arg Pro Asp Met Asn Pro Thr Val Leu Glu Leu
            260             265             270
Ala Lys Leu Asp Phe Asn Met Val Gln Ala Gln Phe Gln Gln Glu Leu
            275             280             285
Lys Glu Ala Ser Arg Trp Trp Asn Ser Thr Gly Leu Val His Glu Leu
    290             295             300
Pro Phe Val Arg Asp Arg Ile Val Glu Cys Tyr Tyr Trp Thr Thr Gly
305             310             315             320
Val Val Glu Arg Arg Glu His Gly Tyr Glu Arg Ile Met Leu Thr Lys
            325             330             335
Ile Asn Ala Leu Val Thr Thr Ile Asp Asp Val Phe Asp Ile Tyr Gly
            340             345             350
Thr Leu Glu Glu Leu Gln Leu Phe Thr Thr Ala Ile Gln Arg Trp Asp
    355             360             365
Ile Glu Ser Met Lys Gln Leu Pro Pro Tyr Met Gln Ile Cys Tyr Leu
    370             375             380
Ala Leu Phe Asn Phe Val Asn Glu Met Ala Tyr Asp Thr Leu Arg Asp
385             390             395             400
Lys Gly Phe Asn Ser Thr Pro Tyr Leu Arg Lys Ala Trp Val Asp Leu
            405             410             415
Val Glu Ser Tyr Leu Ile Glu Ala Lys Trp Tyr Tyr Met Gly His Lys
            420             425             430
Pro Ser Leu Glu Glu Tyr Met Lys Asn Ser Trp Ile Ser Ile Gly Gly
            435             440             445
Ile Pro Ile Leu Ser His Leu Phe Phe Arg Leu Thr Asp Ser Ile Glu
```

```
        450                      455                      460
Glu Glu Asp Ala Glu Ser Met His Lys Tyr His Asp Ile Val Arg Ala
465                      470                      475                      480
Ser Cys Thr Ile Leu Arg Leu Ala Asp Asp Met Gly Thr Ser Leu Asp
                    485                      490                      495
Glu Val Glu Arg Gly Asp Val Pro Lys Ser Val Gln Cys Tyr Met Asn
                500                      505                      510
Glu Lys Asn Ala Ser Glu Glu Glu Ala Arg Glu His Val Arg Ser Leu
            515                      520                      525
Ile Asp Gln Thr Trp Lys Met Met Asn Lys Glu Met Met Thr Ser Ser
        530                      535                      540
Phe Ser Lys Tyr Phe Val Gln Val Ser Ala Asn Leu Ala Arg Met Ala
545                      550                      555                      560
Gln Trp Ile Tyr Gln His Glu Ser Asp Gly Phe Gly Met Gln His Ser
                565                      570                      575
Leu Val Asn Lys Met Leu Arg Gly Leu Leu Phe Asp Arg Tyr Glu
            580                      585                      590
```

<210> 25
<211> 2024
<212> DNA
<213> Salvia officinalis

<220>
<221> CDS
<222> (11)...(1804)
<223> (+)-bornyl diphosphate synthase

<400> 25

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 gatcacaaaa atg tct atc att agc atg aac gta tcg atc ctt agc aag        49
            Met Ser Ile Ile Ser Met Asn Val Ser Ile Leu Ser Lys
             1               5                       10


 cca cta aat tgc ctc cac aac ttg gag agg aga cct tca aaa gcc ttg        97
 Pro Leu Asn Cys Leu His Asn Leu Glu Arg Arg Pro Ser Lys Ala Leu
     15                      20                      25


 ctt gtc cct tgc act gca ccc acc gct cgc ctc cgg gca tct tgc tcc       145
 Leu Val Pro Cys Thr Ala Pro Thr Ala Arg Leu Arg Ala Ser Cys Ser
 30                      35                      40                      45


 tca aaa cta caa gaa gct cat caa atc cga cga tct gga aac tac caa       193
 Ser Lys Leu Gln Glu Ala His Gln Ile Arg Arg Ser Gly Asn Tyr Gln
                 50                      55                      60


 cct gcc ctt tgg gat tcc aat tac att cag tct ctc aat act cca tat       241
 Pro Ala Leu Trp Asp Ser Asn Tyr Ile Gln Ser Leu Asn Thr Pro Tyr
                 65                      70                      75


 acg gag gag agg cac ttg gat aga aaa gca gag ctg att gtg caa gtg       289
 Thr Glu Glu Arg His Leu Asp Arg Lys Ala Glu Leu Ile Val Gln Val
         80                      85                      90


 agg ata ctg cta aag gaa aaa atg gag cct gtt caa caa ttg gag ttg       337
 Arg Ile Leu Leu Lys Glu Lys Met Glu Pro Val Gln Gln Leu Glu Leu
     95                      100                     105
```

```
att cat gac ttg aaa tat ttg ggg ctc tcg gat ttt ttt caa gat gag      385
Ile His Asp Leu Lys Tyr Leu Gly Leu Ser Asp Phe Phe Gln Asp Glu
110             115             120             125

att aag gag atc tta ggt gtt ata tac aat gag cac aaa tgc ttt cac      433
Ile Lys Glu Ile Leu Gly Val Ile Tyr Asn Glu His Lys Cys Phe His
                130             135             140

aat aat gaa gta gag aaa atg gat ttg tat ttc aca gct ctt gga ttc      481
Asn Asn Glu Val Glu Lys Met Asp Leu Tyr Phe Thr Ala Leu Gly Phe
            145             150             155

aga ctc ctc aga caa cat ggt ttt aat att tcc caa gat gta ttt aat      529
Arg Leu Leu Arg Gln His Gly Phe Asn Ile Ser Gln Asp Val Phe Asn
        160             165             170

tgt ttc aag aac gag aag ggt att gat ttc aag gca agc ctt gct caa      577
Cys Phe Lys Asn Glu Lys Gly Ile Asp Phe Lys Ala Ser Leu Ala Gln
        175             180             185

gat acg aag gga atg tta caa ctg tat gaa gcg tct ttc ctt ttg aga      625
Asp Thr Lys Gly Met Leu Gln Leu Tyr Glu Ala Ser Phe Leu Leu Arg
190             195             200             205

aaa ggt gaa gat aca ttg gag ctt gca aga gaa ttt gcc aca aaa tgt      673
Lys Gly Glu Asp Thr Leu Glu Leu Ala Arg Glu Phe Ala Thr Lys Cys
            210             215             220

ctg cag aaa aaa ctt gat gaa ggt ggt aat gaa att gat gag aat cta      721
Leu Gln Lys Lys Leu Asp Glu Gly Gly Asn Glu Ile Asp Glu Asn Leu
            225             230             235

tta ttg tgg att cgc cac tct ttg gat ctt cct ctc cac tgg agg att      769
Leu Leu Trp Ile Arg His Ser Leu Asp Leu Pro Leu His Trp Arg Ile
            240             245             250

caa agt gta gag gca aga tgg ttc ata gat gct tat gcg aga agg cca      817
Gln Ser Val Glu Ala Arg Trp Phe Ile Asp Ala Tyr Ala Arg Arg Pro
255             260             265

gac atg aat cca ctt att ttc gag ctt gcc aaa ctc aac ttc aat att      865
Asp Met Asn Pro Leu Ile Phe Glu Leu Ala Lys Leu Asn Phe Asn Ile
270             275             280             285

att caa gca aca cat caa caa gaa ctg aaa gat ctc tcg agg tgg tgg      913
Ile Gln Ala Thr His Gln Gln Glu Leu Lys Asp Leu Ser Arg Trp Trp
            290             295             300

agt aga tta tgc ttc cct gaa aag ctc cca ttt gtg agg gat agg ctc      961
Ser Arg Leu Cys Phe Pro Glu Lys Leu Pro Phe Val Arg Asp Arg Leu
            305             310             315

gtt gaa tcc ttc ttt tgg gcg gtt ggg atg ttt gag cca cat caa cat     1009
Val Glu Ser Phe Phe Trp Ala Val Gly Met Phe Glu Pro His Gln His
            320             325             330

gga tat cag aga aaa atg gcc gcc aca att att gtt tta gca aca gtt     1057
```

```
Gly Tyr Gln Arg Lys Met Ala Ala Thr Ile Ile Val Leu Ala Thr Val
   335                 340                 345
```

```
ata gat gat att tac gat gtg tat ggt aca cta gat gaa cta gaa cta    1105
Ile Asp Asp Ile Tyr Asp Val Tyr Gly Thr Leu Asp Glu Leu Glu Leu
350                 355                 360                 365
```

```
ttt aca gac acg ttt aag aga tgg gat act gaa tca ata acc cga ctt    1153
Phe Thr Asp Thr Phe Lys Arg Trp Asp Thr Glu Ser Ile Thr Arg Leu
                370                 375                 380
```

```
cct tat tac atg caa tta tgt tat tgg ggt gtc cac aac tat att tcc    1201
Pro Tyr Tyr Met Gln Leu Cys Tyr Trp Gly Val His Asn Tyr Ile Ser
                385                 390                 395
```

```
gat gca gca tat gat att ctc aaa gaa cat ggt ttc ttt tgt ctc caa    1249
Asp Ala Ala Tyr Asp Ile Leu Lys Glu His Gly Phe Phe Cys Leu Gln
        400                 405                 410
```

```
tat ctc cgg aaa tcg gtg gta gat ttg gtt gaa gca tat ttt cac gag    1297
Tyr Leu Arg Lys Ser Val Val Asp Leu Val Glu Ala Tyr Phe His Glu
        415                 420                 425
```

```
gca aag tgg tac cac agc ggt tat aca cca agc ctg gat gaa tat ctc    1345
Ala Lys Trp Tyr His Ser Gly Tyr Thr Pro Ser Leu Asp Glu Tyr Leu
430                 435                 440                 445
```

```
aac atc gcc aag att tca gtg gcg tct cct gca ata ata tcc cca acc    1393
Asn Ile Ala Lys Ile Ser Val Ala Ser Pro Ala Ile Ile Ser Pro Thr
                450                 455                 460
```

```
tat ttc aca ttc gca aac gcg tct cat gac aca gca gtc atc gac agc    1441
Tyr Phe Thr Phe Ala Asn Ala Ser His Asp Thr Ala Val Ile Asp Ser
                465                 470                 475
```

```
ttg tac caa tat cat gac ata ctt tgc cta gca gga att att ttg agg    1489
Leu Tyr Gln Tyr His Asp Ile Leu Cys Leu Ala Gly Ile Ile Leu Arg
                480                 485                 490
```

```
ctt ccc gac gat ctt ggg aca tca tat ttt gag ctg gcg aga ggc gac    1537
Leu Pro Asp Asp Leu Gly Thr Ser Tyr Phe Glu Leu Ala Arg Gly Asp
        495                 500                 505
```

```
gtg ccg aaa aca atc cag tgc tac atg aag gaa aca aat gct agt gag    1585
Val Pro Lys Thr Ile Gln Cys Tyr Met Lys Glu Thr Asn Ala Ser Glu
510                 515                 520                 525
```

```
gag gag gcg gtg gag cac gtg aag ttt ctg ata agg gag gcg tgg aag    1633
Glu Glu Ala Val Glu His Val Lys Phe Leu Ile Arg Glu Ala Trp Lys
                530                 535                 540
```

```
gat atg aac acg gcc ata gca gcc ggt tat ccg ttt ccg gat ggt atg    1681
Asp Met Asn Thr Ala Ile Ala Ala Gly Tyr Pro Phe Pro Asp Gly Met
                545                 550                 555
```

```
gtg gcg ggc gca gct aat att ggg cgc gtg gcg cag ttt att tat ctc    1729
Val Ala Gly Ala Ala Asn Ile Gly Arg Val Ala Gln Phe Ile Tyr Leu
```

```
                560                    565                     570
cac gga gat ggg ttt ggc gtg caa cac tcg aaa acg tac gag cat atc    1777
His Gly Asp Gly Phe Gly Val Gln His Ser Lys Thr Tyr Glu His Ile
    575                 580                 585

gcc ggc cta ctg ttc gag cct tat gca tga acaaatggga gactgcttga      1827
Ala Gly Leu Leu Phe Glu Pro Tyr Ala
590                 595

tatatattaa tttggcacac caataattgc atgttatata tgttggaaaa taagtgtctg   1887
gttgagatgt catgtggtgt attatctaaa taattcaagg ttgccttgtt tatgtagccg   1947
gtggtgcaac tacctcccat tcaaatcaat taaatctaaa cagtcgagtc aagctcgagc   2007
tcgaggaaaa aaaaaaa                                                  2024
```

<210> 26
<211> 598
<212> PRT
<213> Salvia officinalis

<400> 26
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Met Ser Ile Ile Ser Met Asn Val Ser Ile Leu Ser Lys Pro Leu Asn
1               5                   10                  15
Cys Leu His Asn Leu Glu Arg Arg Pro Ser Lys Ala Leu Leu Val Pro
            20                  25                  30
Cys Thr Ala Pro Thr Ala Arg Leu Arg Ala Ser Cys Ser Ser Lys Leu
            35                  40                  45
Gln Glu Ala His Gln Ile Arg Arg Ser Gly Asn Tyr Gln Pro Ala Leu
            50                  55                  60
Trp Asp Ser Asn Tyr Ile Gln Ser Leu Asn Thr Pro Tyr Thr Glu Glu
65                  70                  75                  80
Arg His Leu Asp Arg Lys Ala Glu Leu Ile Val Gln Val Arg Ile Leu
                85                  90                  95
Leu Lys Glu Lys Met Glu Pro Val Gln Gln Leu Glu Leu Ile His Asp
            100                 105                 110
Leu Lys Tyr Leu Gly Leu Ser Asp Phe Phe Gln Asp Glu Ile Lys Glu
            115                 120                 125
Ile Leu Gly Val Ile Tyr Asn Glu His Lys Cys Phe His Asn Asn Glu
            130                 135                 140
Val Glu Lys Met Asp Leu Tyr Phe Thr Ala Leu Gly Phe Arg Leu Leu
145                 150                 155                 160
Arg Gln His Gly Phe Asn Ile Ser Gln Asp Val Phe Asn Cys Phe Lys
                165                 170                 175
Asn Glu Lys Gly Ile Asp Phe Lys Ala Ser Leu Ala Gln Asp Thr Lys
            180                 185                 190
Gly Met Leu Gln Leu Tyr Glu Ala Ser Phe Leu Leu Arg Lys Gly Glu
            195                 200                 205
Asp Thr Leu Glu Leu Ala Arg Glu Phe Ala Thr Lys Cys Leu Gln Lys
            210                 215                 220
Lys Leu Asp Glu Gly Gly Asn Glu Ile Asp Glu Asn Leu Leu Leu Trp
225                 230                 235                 240
Ile Arg His Ser Leu Asp Leu Pro Leu His Trp Arg Ile Gln Ser Val
                245                 250                 255
Glu Ala Arg Trp Phe Ile Asp Ala Tyr Ala Arg Arg Pro Asp Met Asn
                260                 265                 270
Pro Leu Ile Phe Glu Leu Ala Lys Leu Asn Phe Asn Ile Ile Gln Ala
            275                 280                 285
```

```
Thr His Gln Gln Glu Leu Lys Asp Leu Ser Arg Trp Trp Ser Arg Leu
    290                 295                 300
Cys Phe Pro Glu Lys Leu Pro Phe Val Arg Asp Arg Leu Val Glu Ser
305                 310                 315                 320
Phe Phe Trp Ala Val Gly Met Phe Glu Pro His Gln His Gly Tyr Gln
                325                 330                 335
Arg Lys Met Ala Ala Thr Ile Ile Val Leu Ala Thr Val Ile Asp Asp
                340                 345                 350
Ile Tyr Asp Val Tyr Gly Thr Leu Asp Glu Leu Glu Leu Phe Thr Asp
                355                 360                 365
Thr Phe Lys Arg Trp Asp Thr Glu Ser Ile Thr Arg Leu Pro Tyr Tyr
    370                 375                 380
Met Gln Leu Cys Tyr Trp Gly Val His Asn Tyr Ile Ser Asp Ala Ala
385                 390                 395                 400
Tyr Asp Ile Leu Lys Glu His Gly Phe Phe Cys Leu Gln Tyr Leu Arg
                405                 410                 415
Lys Ser Val Val Asp Leu Val Glu Ala Tyr Phe His Glu Ala Lys Trp
                420                 425                 430
Tyr His Ser Gly Tyr Thr Pro Ser Leu Asp Glu Tyr Leu Asn Ile Ala
                435                 440                 445
Lys Ile Ser Val Ala Ser Pro Ala Ile Ile Ser Pro Thr Tyr Phe Thr
    450                 455                 460
Phe Ala Asn Ala Ser His Asp Thr Ala Val Ile Asp Ser Leu Tyr Gln
465                 470                 475                 480
Tyr His Asp Ile Leu Cys Leu Ala Gly Ile Ile Leu Arg Leu Pro Asp
                485                 490                 495
Asp Leu Gly Thr Ser Tyr Phe Glu Leu Ala Arg Gly Asp Val Pro Lys
                500                 505                 510
Thr Ile Gln Cys Tyr Met Lys Glu Thr Asn Ala Ser Glu Glu Glu Ala
    515                 520                 525
Val Glu His Val Lys Phe Leu Ile Arg Glu Ala Trp Lys Asp Met Asn
    530                 535                 540
Thr Ala Ile Ala Ala Gly Tyr Pro Phe Pro Asp Gly Met Val Ala Gly
545                 550                 555                 560
Ala Ala Asn Ile Gly Arg Val Ala Gln Phe Ile Tyr Leu His Gly Asp
                565                 570                 575
Gly Phe Gly Val Gln His Ser Lys Thr Tyr Glu His Ile Ala Gly Leu
                580                 585                 590
Leu Phe Glu Pro Tyr Ala
                595
```

```
<210> 27
<211> 1959
<212> DNA
<213> Mentha x piperita

<220>
<221> CDS
<222> (71)...(1720)
<223> (E)-B-farnesene synthase

<400> 27
aaactctgca atttcatata taacatcata aaatcagaga gagagacaga gagtttgttg      60
tagtgaaaaa atg gct aca aac ggc gtc gta att agt tgc tta agg gaa     109
          Met Ala Thr Asn Gly Val Val Ile Ser Cys Leu Arg Glu
            1               5                   10
```

```
gta agg cca cct atg acg aag cat gcg cca agc atg tgg act gat acc      157
Val Arg Pro Pro Met Thr Lys His Ala Pro Ser Met Trp Thr Asp Thr
        15                  20                  25

ttt tct aac ttt tct ctt gac gat aag gaa caa caa aag tgc tca gaa      205
Phe Ser Asn Phe Ser Leu Asp Asp Lys Glu Gln Gln Lys Cys Ser Glu
 30                  35                  40                  45

acc atc gaa gca ctt aag caa gaa gca aga ggc atg ctt atg gct gca      253
Thr Ile Glu Ala Leu Lys Gln Glu Ala Arg Gly Met Leu Met Ala Ala
                    50                  55                  60

acc act cct ctc caa caa atg aca cta atc gac act ctc gag cgt ttg      301
Thr Thr Pro Leu Gln Gln Met Thr Leu Ile Asp Thr Leu Glu Arg Leu
            65                  70                  75

gga ttg tct ttc cat ttt gag acg gag atc gaa tac aaa atc gaa cta      349
Gly Leu Ser Phe His Phe Glu Thr Glu Ile Glu Tyr Lys Ile Glu Leu
        80                  85                  90

atc aac gct gca gaa gac gac ggc ttt gat ttg ttc gct act gct ctt      397
Ile Asn Ala Ala Glu Asp Asp Gly Phe Asp Leu Phe Ala Thr Ala Leu
        95                  100                 105

cgt ttc cgt ttg ctc aga caa cat caa cgc cac gtt tct tgt gat gtt      445
Arg Phe Arg Leu Leu Arg Gln His Gln Arg His Val Ser Cys Asp Val
110                 115                 120                 125

ttc gac aag ttc atc gac aaa gat ggc aag ttc gaa gaa tcc ctt agc      493
Phe Asp Lys Phe Ile Asp Lys Asp Gly Lys Phe Glu Glu Ser Leu Ser
                    130                 135                 140

aat aat gtt gaa ggc cta tta agc ttg tat gaa gca gct cat gtt ggg      541
Asn Asn Val Glu Gly Leu Leu Ser Leu Tyr Glu Ala Ala His Val Gly
                145                 150                 155

ttt cgc gaa gaa aga ata tta caa gag gct gta aat ttt acg agg cat      589
Phe Arg Glu Glu Arg Ile Leu Gln Glu Ala Val Asn Phe Thr Arg His
            160                 165                 170

cac ttg gaa gga gca gag tta gat cag tct cca tta ttg att aga gag      637
His Leu Glu Gly Ala Glu Leu Asp Gln Ser Pro Leu Leu Ile Arg Glu
        175                 180                 185

aaa gtg aag cga gct ttg gag cac cct ctt cat agg gat ttc ccc att      685
Lys Val Lys Arg Ala Leu Glu His Pro Leu His Arg Asp Phe Pro Ile
190                 195                 200                 205

gtc tat gca cgc ctt ttc atc tcc att tac gaa aag gat gac tct aga      733
Val Tyr Ala Arg Leu Phe Ile Ser Ile Tyr Glu Lys Asp Asp Ser Arg
                    210                 215                 220

gat gaa tta ctt ctc aag cta tcc aaa gtc aac ttc aaa ttc atg cag      781
Asp Glu Leu Leu Leu Lys Leu Ser Lys Val Asn Phe Lys Phe Met Gln
                225                 230                 235

aat ttg tat aag gaa gag ctc tcc caa ctc tcc agg tgg tgg aac aca      829
```

```
       Asn Leu Tyr Lys Glu Glu Leu Ser Gln Leu Ser Arg Trp Trp Asn Thr
               240             245             250

       tgg aat ctg aaa tca aaa tta cca tat gca aga gat cga gtc gtg gag      877
       Trp Asn Leu Lys Ser Lys Leu Pro Tyr Ala Arg Asp Arg Val Val Glu
               255             260             265

       gct tat gtt tgg gga gta ggt tac cat tac gaa ccc caa tac tca tat      925
       Ala Tyr Val Trp Gly Val Gly Tyr His Tyr Glu Pro Gln Tyr Ser Tyr
       270             275             280             285

       gtt cga atg gga ctt gcc aaa ggc gta cta att tgt gga atc atg gac      973
       Val Arg Met Gly Leu Ala Lys Gly Val Leu Ile Cys Gly Ile Met Asp
                       290             295             300

       gat aca tat gat aat tat gct aca ctc aat gaa gct caa ctt ttt act     1021
       Asp Thr Tyr Asp Asn Tyr Ala Thr Leu Asn Glu Ala Gln Leu Phe Thr
                       305             310             315

       caa gtc tta gac aag tgg gat aga gat gaa gct gaa cga ctc cca gaa     1069
       Gln Val Leu Asp Lys Trp Asp Arg Asp Glu Ala Glu Arg Leu Pro Glu
                       320             325             330

       tac atg aaa atc gtt tat cga ttt att ttg agt ata tat gaa aat tat     1117
       Tyr Met Lys Ile Val Tyr Arg Phe Ile Leu Ser Ile Tyr Glu Asn Tyr
                       335             340             345

       gaa cgt gat gca gcg aaa ctt gga aaa agc ttt gca gct cct tat ttt     1165
       Glu Arg Asp Ala Ala Lys Leu Gly Lys Ser Phe Ala Ala Pro Tyr Phe
       350             355             360             365

       aag gaa acc gtg aaa caa ctg gca agg gca ttt aat gag gag cag aag     1213
       Lys Glu Thr Val Lys Gln Leu Ala Arg Ala Phe Asn Glu Glu Gln Lys
                       370             375             380

       tgg gtt atg gaa agg cag cta ccg tca ttc caa gac tac gta aag aat     1261
       Trp Val Met Glu Arg Gln Leu Pro Ser Phe Gln Asp Tyr Val Lys Asn
                       385             390             395

       tca gag aaa acc agc tgc att tat acc atg ttt gct tct atc atc cca     1309
       Ser Glu Lys Thr Ser Cys Ile Tyr Thr Met Phe Ala Ser Ile Ile Pro
                       400             405             410

       ggc ttg aaa tct gtt acc caa gaa acc att gat tgg atc aag agt gaa     1357
       Gly Leu Lys Ser Val Thr Gln Glu Thr Ile Asp Trp Ile Lys Ser Glu
                       415             420             425

       ccc acg ctc gca aca tcg acc gct atg atc ggt cgg tat tgg aat gac     1405
       Pro Thr Leu Ala Thr Ser Thr Ala Met Ile Gly Arg Tyr Trp Asn Asp
       430             435             440             445

       acc agc tct cag ctc cgt gaa agc aaa gga ggg gaa atg ctg act gcg     1453
       Thr Ser Ser Gln Leu Arg Glu Ser Lys Gly Gly Glu Met Leu Thr Ala
                       450             455             460

       ttg gat ttc cac atg aaa gaa tat ggt ctg acg aag gaa gag gcg gca     1501
       Leu Asp Phe His Met Lys Glu Tyr Gly Leu Thr Lys Glu Glu Ala Ala
```

```
               465                      470                      475

tct aag ttt gaa gga ttg gtt gag gaa aca tgg aag gat ata aac aag    1549
Ser Lys Phe Glu Gly Leu Val Glu Glu Thr Trp Lys Asp Ile Asn Lys
            480                      485                  490

gaa ttc ata gcc aca act aat tat aat gtg ggt aga gaa att gcc atc    1597
Glu Phe Ile Ala Thr Thr Asn Tyr Asn Val Gly Arg Glu Ile Ala Ile
            495                  500                  505

aca ttc ctc aac tac gct cgg ata tgt gaa gcc agt tac agc aaa act    1645
Thr Phe Leu Asn Tyr Ala Arg Ile Cys Glu Ala Ser Tyr Ser Lys Thr
510                  515                  520                  525

gac gga gac gct tat tca gat cct aat gtt gcc aag gca aat gtc gtt    1693
Asp Gly Asp Ala Tyr Ser Asp Pro Asn Val Ala Lys Ala Asn Val Val
                530                  535                  540

gct ctc ttt gtt gat gcc ata gtc ttt tga tttgcataat caaagaccct     1743
Ala Leu Phe Val Asp Ala Ile Val Phe
                545                  550

ataattataa ttatatgtgt ttaagaaact aataagcttg ctttatgtat agttgtcaat  1803
tgaataataa tgtattaatt agtagagtta agaagttata aagaataaag aggagctggt  1863
agacgtaaac aagaaataat gtgtcaaaat aacttcaact ttttcaagaa taaagaattg  1923
gaagagacca atatatacaa aaaaaaaaaa aaaaaa                            1959
```

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<210> 28
<211> 550
<212> PRT
<213> Mentha x piperita

<400> 28
Met Ala Thr Asn Gly Val Val Ile Ser Cys Leu Arg Glu Val Arg Pro
1               5                   10                  15
Pro Met Thr Lys His Ala Pro Ser Met Trp Thr Asp Thr Phe Ser Asn
            20                  25                  30
Phe Ser Leu Asp Asp Lys Glu Gln Gln Lys Cys Ser Glu Thr Ile Glu
        35                  40                  45
Ala Leu Lys Gln Glu Ala Arg Gly Met Leu Met Ala Ala Thr Thr Pro
    50                  55                  60
Leu Gln Gln Met Thr Leu Ile Asp Thr Leu Glu Arg Leu Gly Leu Ser
65                  70                  75                  80
Phe His Phe Glu Thr Glu Ile Glu Tyr Lys Ile Glu Leu Ile Asn Ala
            85                  90                  95
Ala Glu Asp Asp Gly Phe Asp Leu Phe Ala Thr Ala Leu Arg Phe Arg
            100                 105                 110
Leu Leu Arg Gln His Gln Arg His Val Ser Cys Asp Val Phe Asp Lys
        115                 120                 125
Phe Ile Asp Lys Asp Gly Lys Phe Glu Glu Ser Leu Ser Asn Asn Val
        130                 135                 140
Glu Gly Leu Leu Ser Leu Tyr Glu Ala Ala His Val Gly Phe Arg Glu
145                 150                 155                 160
Glu Arg Ile Leu Gln Glu Ala Val Asn Phe Thr Arg His His Leu Glu
                165                 170                 175
Gly Ala Glu Leu Asp Gln Ser Pro Leu Leu Ile Arg Glu Lys Val Lys
            180                 185                 190
```

```
Arg Ala Leu Glu His Pro Leu His Arg Asp Phe Pro Ile Val Tyr Ala
        195             200             205
Arg Leu Phe Ile Ser Ile Tyr Glu Lys Asp Asp Ser Arg Asp Glu Leu
210             215             220
Leu Leu Lys Leu Ser Lys Val Asn Phe Lys Phe Met Gln Asn Leu Tyr
225             230             235             240
Lys Glu Glu Leu Ser Gln Leu Ser Arg Trp Trp Asn Thr Trp Asn Leu
            245             250             255
Lys Ser Lys Leu Pro Tyr Ala Arg Asp Arg Val Val Glu Ala Tyr Val
            260             265             270
Trp Gly Val Gly Tyr His Tyr Glu Pro Gln Tyr Ser Tyr Val Arg Met
            275             280             285
Gly Leu Ala Lys Gly Val Leu Ile Cys Gly Ile Met Asp Asp Thr Tyr
        290             295             300
Asp Asn Tyr Ala Thr Leu Asn Glu Ala Gln Leu Phe Thr Gln Val Leu
305             310             315             320
Asp Lys Trp Asp Arg Asp Glu Ala Glu Arg Leu Pro Glu Tyr Met Lys
            325             330             335
Ile Val Tyr Arg Phe Ile Leu Ser Ile Tyr Glu Asn Tyr Glu Arg Asp
            340             345             350
Ala Ala Lys Leu Gly Lys Ser Phe Ala Ala Pro Tyr Phe Lys Glu Thr
            355             360             365
Val Lys Gln Leu Ala Arg Ala Phe Asn Glu Glu Gln Lys Trp Val Met
        370             375             380
Glu Arg Gln Leu Pro Ser Phe Gln Asp Tyr Val Lys Asn Ser Glu Lys
385             390             395             400
Thr Ser Cys Ile Tyr Thr Met Phe Ala Ser Ile Ile Pro Gly Leu Lys
            405             410             415
Ser Val Thr Gln Glu Thr Ile Asp Trp Ile Lys Ser Glu Pro Thr Leu
            420             425             430
Ala Thr Ser Thr Ala Met Ile Gly Arg Tyr Trp Asn Asp Thr Ser Ser
        435             440             445
Gln Leu Arg Glu Ser Lys Gly Gly Glu Met Leu Thr Ala Leu Asp Phe
    450             455             460
His Met Lys Glu Tyr Gly Leu Thr Lys Glu Glu Ala Ala Ser Lys Phe
465             470             475             480
Glu Gly Leu Val Glu Glu Thr Trp Lys Asp Ile Asn Lys Glu Phe Ile
            485             490             495
Ala Thr Thr Asn Tyr Asn Val Gly Arg Glu Ile Ala Ile Thr Phe Leu
            500             505             510
Asn Tyr Ala Arg Ile Cys Glu Ala Ser Tyr Ser Lys Thr Asp Gly Asp
            515             520             525
Ala Tyr Ser Asp Pro Asn Val Ala Lys Ala Asn Val Val Ala Leu Phe
    530             535             540
Val Asp Ala Ile Val Phe
545             550
```

<210> 29
<211> 2196
<212> DNA
<213> Abies grandis

<220>
<221> CDS
<222> (69)...(1949)
<223> myrcene synthase

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<400> 29
tgccggcacg aggttatctt gagcttcctc catataggcc aacacatatc atatcaaagg        60
gagcaaga atg gct ctg gtt tct atc tca ccg ttg gct tcg aaa tct tgc        110
          Met Ala Leu Val Ser Ile Ser Pro Leu Ala Ser Lys Ser Cys
            1               5                   10

ctg cgc aag tcg ttg atc agt tca att cat gaa cat aag cct ccc tat        158
Leu Arg Lys Ser Leu Ile Ser Ser Ile His Glu His Lys Pro Pro Tyr
 15                  20                  25                  30

aga aca atc cca aat ctt gga atg cgt agg cga ggg aaa tct gtc acg        206
Arg Thr Ile Pro Asn Leu Gly Met Arg Arg Arg Gly Lys Ser Val Thr
                     35                  40                  45

cct tcc atg agc atc agt ttg gcc acc gct gca cct gat gat ggt gta        254
Pro Ser Met Ser Ile Ser Leu Ala Thr Ala Ala Pro Asp Asp Gly Val
             50                  55                  60

caa aga cgc ata ggt gac tac cat tcc aat atc tgg gac gat gat ttc        302
Gln Arg Arg Ile Gly Asp Tyr His Ser Asn Ile Trp Asp Asp Asp Phe
         65                  70                  75

ata cag tct cta tca acg cct tat ggg gaa ccc tct tac cag gaa cgt        350
Ile Gln Ser Leu Ser Thr Pro Tyr Gly Glu Pro Ser Tyr Gln Glu Arg
     80                  85                  90

gct gag aga tta att gtg gag gta aag aag ata ttc aat tca atg tac        398
Ala Glu Arg Leu Ile Val Glu Val Lys Lys Ile Phe Asn Ser Met Tyr
 95                  100                 105                 110

ctg gat gat gga aga tta atg agt tcc ttt aat gat ctc atg caa cgc        446
Leu Asp Asp Gly Arg Leu Met Ser Ser Phe Asn Asp Leu Met Gln Arg
                     115                 120                 125

ctt tgg ata gtc gat agc gtt gaa cgt ttg ggg ata gct aga cat ttc        494
Leu Trp Ile Val Asp Ser Val Glu Arg Leu Gly Ile Ala Arg His Phe
                 130                 135                 140

aag aac gag ata aca tca gct ctg gat tat gtt ttc cgt tac tgg gag        542
Lys Asn Glu Ile Thr Ser Ala Leu Asp Tyr Val Phe Arg Tyr Trp Glu
         145                 150                 155

gaa aac ggc att gga tgt ggg aga gac agt att gtt act gat ctc aac        590
Glu Asn Gly Ile Gly Cys Gly Arg Asp Ser Ile Val Thr Asp Leu Asn
     160                 165                 170

tca act gcg ttg ggg ttt cga act ctt cga tta cac ggg tac act gta        638
Ser Thr Ala Leu Gly Phe Arg Thr Leu Arg Leu His Gly Tyr Thr Val
175                 180                 185                 190

tct cca gag gtt tta aaa gct ttt caa gat caa aat gga cag ttt gta        686
Ser Pro Glu Val Leu Lys Ala Phe Gln Asp Gln Asn Gly Gln Phe Val
                 195                 200                 205

tgc tcc ccc ggt cag aca gag ggt gag atc aga agc gtt ctt aac tta        734
Cys Ser Pro Gly Gln Thr Glu Gly Glu Ile Arg Ser Val Leu Asn Leu
             210                 215                 220
```

```
tat cgg gct tcc ctc att gcc ttc cct ggt gag aaa gtt atg gaa gaa    782
Tyr Arg Ala Ser Leu Ile Ala Phe Pro Gly Glu Lys Val Met Glu Glu
        225                     230                 235

gct gaa atc ttc tcc aca aga tat ttg aaa gaa gct cta caa aag att    830
Ala Glu Ile Phe Ser Thr Arg Tyr Leu Lys Glu Ala Leu Gln Lys Ile
        240                     245                 250

cca gtc tcc gct ctt tca caa gag ata aag ttt gtt atg gaa tat ggc    878
Pro Val Ser Ala Leu Ser Gln Glu Ile Lys Phe Val Met Glu Tyr Gly
255                     260                 265                 270

tgg cac aca aat ttg cca aga ttg gaa gca aga aat tac ata gac aca    926
Trp His Thr Asn Leu Pro Arg Leu Glu Ala Arg Asn Tyr Ile Asp Thr
                275                 280                 285

ctt gag aaa gac acc agt gca tgg ctc aat aaa aat gct ggg aag aag    974
Leu Glu Lys Asp Thr Ser Ala Trp Leu Asn Lys Asn Ala Gly Lys Lys
                290                 295                 300

ctt tta gaa ctt gca aaa ttg gag ttc aat ata ttt aac tcc tta caa   1022
Leu Leu Glu Leu Ala Lys Leu Glu Phe Asn Ile Phe Asn Ser Leu Gln
                305                 310                 315

caa aag gaa tta caa tat ctt ttg aga tgg tgg aaa gag tcg gat ttg   1070
Gln Lys Glu Leu Gln Tyr Leu Leu Arg Trp Trp Lys Glu Ser Asp Leu
        320                     325                 330

cct aaa ttg aca ttt gct cgg cat cgt cat gtg gaa ttc tac act ttg   1118
Pro Lys Leu Thr Phe Ala Arg His Arg His Val Glu Phe Tyr Thr Leu
335                     340                 345                 350

gcc tct tgt att gcc att gac cca aaa cat tct gca ttc aga cta ggc   1166
Ala Ser Cys Ile Ala Ile Asp Pro Lys His Ser Ala Phe Arg Leu Gly
                355                 360                 365

ttc gcc aaa atg tgt cat ctt gtc aca gtt ttg gac gat att tac gac   1214
Phe Ala Lys Met Cys His Leu Val Thr Val Leu Asp Asp Ile Tyr Asp
                370                 375                 380

act ttt gga acg att gac gag ctt gaa ctc ttc aca tct gca att aag   1262
Thr Phe Gly Thr Ile Asp Glu Leu Glu Leu Phe Thr Ser Ala Ile Lys
                385                 390                 395

aga tgg aat tca tca gag ata gaa cac ctt cca gaa tat atg aaa tgt   1310
Arg Trp Asn Ser Ser Glu Ile Glu His Leu Pro Glu Tyr Met Lys Cys
        400                     405                 410

gtg tac atg gtc gtg ttt gaa act gta aat gaa ctg aca cga gag gcg   1358
Val Tyr Met Val Val Phe Glu Thr Val Asn Glu Leu Thr Arg Glu Ala
415                     420                 425                 430

gag aag act caa ggg aga aac act ctc aac tat gtt cga aag gct tgg   1406
Glu Lys Thr Gln Gly Arg Asn Thr Leu Asn Tyr Val Arg Lys Ala Trp
                435                 440                 445
```

```
gag gct tat ttt gat tca tat atg gaa gaa gca aaa tgg atc tct aat    1454
Glu Ala Tyr Phe Asp Ser Tyr Met Glu Glu Ala Lys Trp Ile Ser Asn
            450                 455                 460

ggt tat ctg cca atg ttt gaa gag tac cat gag aat ggg aaa gtg agc    1502
Gly Tyr Leu Pro Met Phe Glu Glu Tyr His Glu Asn Gly Lys Val Ser
            465                 470                 475

tct gca tat cgc gta gca aca ttg caa ccc atc ctc act ttg aat gca    1550
Ser Ala Tyr Arg Val Ala Thr Leu Gln Pro Ile Leu Thr Leu Asn Ala
            480                 485                 490

tgg ctt cct gat tac atc ttg aag gga att gat ttt cca tcc agg ttc    1598
Trp Leu Pro Asp Tyr Ile Leu Lys Gly Ile Asp Phe Pro Ser Arg Phe
495                 500                 505                 510

aat gat ttg gca tcg tcc ttc ctt cgg cta cga ggt gac aca cgc tgc    1646
Asn Asp Leu Ala Ser Ser Phe Leu Arg Leu Arg Gly Asp Thr Arg Cys
                515                 520                 525

tac aag gcc gat agg gat cgt ggt gaa gaa gct tcg tgt ata tca tgt    1694
Tyr Lys Ala Asp Arg Asp Arg Gly Glu Glu Ala Ser Cys Ile Ser Cys
            530                 535                 540

tat atg aaa gac aat cct gga tca acc gaa gaa gat gcc ctc aat cat    1742
Tyr Met Lys Asp Asn Pro Gly Ser Thr Glu Glu Asp Ala Leu Asn His
            545                 550                 555

atc aat gcc atg gtc aat gac ata atc aaa gaa tta aat tgg gaa ctt    1790
Ile Asn Ala Met Val Asn Asp Ile Ile Lys Glu Leu Asn Trp Glu Leu
            560                 565                 570

cta aga tcc aac gac aat att cca atg ctg gcc aag aaa cat gct ttt    1838
Leu Arg Ser Asn Asp Asn Ile Pro Met Leu Ala Lys Lys His Ala Phe
575                 580                 585                 590

gac ata aca aga gct ctc cac cat ctc tac ata tat cga gat ggc ttt    1886
Asp Ile Thr Arg Ala Leu His His Leu Tyr Ile Tyr Arg Asp Gly Phe
                595                 600                 605

agt gtt gcc aac aag gaa aca aaa aaa ttg gtt atg gaa aca ctc ctt    1934
Ser Val Ala Asn Lys Glu Thr Lys Lys Leu Val Met Glu Thr Leu Leu
            610                 615                 620

gaa tct atg ctt ttt taa ctataaccat atccataata ataagctcat    1982
Glu Ser Met Leu Phe
            625

aatgctaaat tattggcctt atgacatagt ttatgtatgt acttgtgtga attcaatcat    2042
atcgtgtggg tatgattaaa aagctagagc ttactaggtt agtaacatgg tgataaaagt    2102
tataaaatgt gagttataga datacccatg ttgaataatg aattacaaaa agagaaattt    2162
atgtagaata agattggaag cttttcaatt gttt                                2196
```

<210> 30
<211> 627
<212> PRT
<213> Abies grandis

<400> 30

```
Met Ala Leu Val Ser Ile Ser Pro Leu Ala Ser Lys Ser Cys Leu Arg
1               5                   10                  15
Lys Ser Leu Ile Ser Ser Ile His Glu His Lys Pro Pro Tyr Arg Thr
            20                  25                  30
Ile Pro Asn Leu Gly Met Arg Arg Arg Gly Lys Ser Val Thr Pro Ser
            35                  40                  45
Met Ser Ile Ser Leu Ala Thr Ala Ala Pro Asp Asp Gly Val Gln Arg
    50                  55                  60
Arg Ile Gly Asp Tyr His Ser Asn Ile Trp Asp Asp Asp Phe Ile Gln
65                  70                  75                  80
Ser Leu Ser Thr Pro Tyr Gly Glu Pro Ser Tyr Gln Glu Arg Ala Glu
                85                  90                  95
Arg Leu Ile Val Glu Val Lys Lys Ile Phe Asn Ser Met Tyr Leu Asp
            100                 105                 110
Asp Gly Arg Leu Met Ser Ser Phe Asn Asp Leu Met Gln Arg Leu Trp
            115                 120                 125
Ile Val Asp Ser Val Glu Arg Leu Gly Ile Ala Arg His Phe Lys Asn
            130                 135                 140
Glu Ile Thr Ser Ala Leu Asp Tyr Val Phe Arg Tyr Trp Glu Glu Asn
145                 150                 155                 160
Gly Ile Gly Cys Gly Arg Asp Ser Ile Val Thr Asp Leu Asn Ser Thr
                165                 170                 175
Ala Leu Gly Phe Arg Thr Leu Arg Leu His Gly Tyr Thr Val Ser Pro
                180                 185                 190
Glu Val Leu Lys Ala Phe Gln Asp Gln Asn Gly Gln Phe Val Cys Ser
            195                 200                 205
Pro Gly Gln Thr Glu Gly Glu Ile Arg Ser Val Leu Asn Leu Tyr Arg
    210                 215                 220
Ala Ser Leu Ile Ala Phe Pro Gly Glu Lys Val Met Glu Glu Ala Glu
225                 230                 235                 240
Ile Phe Ser Thr Arg Tyr Leu Lys Glu Ala Leu Gln Lys Ile Pro Val
                245                 250                 255
Ser Ala Leu Ser Gln Glu Ile Lys Phe Val Met Glu Tyr Gly Trp His
            260                 265                 270
Thr Asn Leu Pro Arg Leu Glu Ala Arg Asn Tyr Ile Asp Thr Leu Glu
    275                 280                 285
Lys Asp Thr Ser Ala Trp Leu Asn Lys Asn Ala Gly Lys Lys Leu Leu
    290                 295                 300
Glu Leu Ala Lys Leu Glu Phe Asn Ile Phe Asn Ser Leu Gln Gln Lys
305                 310                 315                 320
Glu Leu Gln Tyr Leu Leu Arg Trp Trp Lys Glu Ser Asp Leu Pro Lys
                325                 330                 335
Leu Thr Phe Ala Arg His Arg His Val Glu Phe Tyr Thr Leu Ala Ser
                340                 345                 350
Cys Ile Ala Ile Asp Pro Lys His Ser Ala Phe Arg Leu Gly Phe Ala
            355                 360                 365
Lys Met Cys His Leu Val Thr Val Leu Asp Asp Ile Tyr Asp Thr Phe
    370                 375                 380
Gly Thr Ile Asp Glu Leu Glu Leu Phe Thr Ser Ala Ile Lys Arg Trp
385                 390                 395                 400
Asn Ser Ser Glu Ile Glu His Leu Pro Glu Tyr Met Lys Cys Val Tyr
                405                 410                 415
Met Val Val Phe Glu Thr Val Asn Glu Leu Thr Arg Glu Ala Glu Lys
                420                 425                 430
Thr Gln Gly Arg Asn Thr Leu Asn Tyr Val Arg Lys Ala Trp Glu Ala
```

```
            435                  440                  445
Tyr Phe Asp Ser Tyr Met Glu Glu Ala Lys Trp Ile Ser Asn Gly Tyr
    450                  455                  460
Leu Pro Met Phe Glu Glu Tyr His Glu Asn Gly Lys Val Ser Ser Ala
465                  470                  475                  480
Tyr Arg Val Ala Thr Leu Gln Pro Ile Leu Thr Leu Asn Ala Trp Leu
                485                  490                  495
Pro Asp Tyr Ile Leu Lys Gly Ile Asp Phe Pro Ser Arg Phe Asn Asp
                500                  505                  510
Leu Ala Ser Ser Phe Leu Arg Leu Arg Gly Asp Thr Arg Cys Tyr Lys
                515                  520                  525
Ala Asp Arg Asp Arg Gly Glu Glu Ala Ser Cys Ile Ser Cys Tyr Met
    530                  535                  540
Lys Asp Asn Pro Gly Ser Thr Glu Glu Asp Ala Leu Asn His Ile Asn
545                  550                  555                  560
Ala Met Val Asn Asp Ile Ile Lys Glu Leu Asn Trp Glu Leu Leu Arg
                565                  570                  575
Ser Asn Asp Asn Ile Pro Met Leu Ala Lys Lys His Ala Phe Asp Ile
                580                  585                  590
Thr Arg Ala Leu His His Leu Tyr Ile Tyr Arg Asp Gly Phe Ser Val
                595                  600                  605
Ala Asn Lys Glu Thr Lys Lys Leu Val Met Glu Thr Leu Leu Glu Ser
    610                  615                  620
Met Leu Phe
625
```

```
<210> 31
<211> 1944
<212> DNA
<213> Solanum tuberosum

<220>
<221> CDS
<222> (57)...(1724)
<223> vetispiradiene synthase

<400> 31
  gaaagaaaga aaattctctc tgttttttcc acaagcaaag agtacacaca ctagaa atg     59
                                                                Met
                                                                  1


  acc cca gct gct gta gta atg agt aac tac gga gag gag gag att gtt    107
  Thr Pro Ala Ala Val Val Met Ser Asn Tyr Gly Glu Glu Glu Ile Val
              5                  10                  15


  cgc ccc ata gct gac ttc tct cca agt ctt tgg ggt gat cgt ttt cat    155
  Arg Pro Ile Ala Asp Phe Ser Pro Ser Leu Trp Gly Asp Arg Phe His
              20                  25                  30


  tca ttc tcc ctc gac aat cag att gct gga aaa tat gct caa gag atc    203
  Ser Phe Ser Leu Asp Asn Gln Ile Ala Gly Lys Tyr Ala Gln Glu Ile
              35                  40                  45


  gaa act ttg aag gaa caa tca aga att ata tta tct gca tct tct cga    251
  Glu Thr Leu Lys Glu Gln Ser Arg Ile Ile Leu Ser Ala Ser Ser Arg
  50                  55                  60                  65
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aga aca ttg gct gag aaa ttg gat ctg ata gac att gtt gag cgc ctt        299
Arg Thr Leu Ala Glu Lys Leu Asp Leu Ile Asp Ile Val Glu Arg Leu
            70                  75                  80

ggc att gct tat cat ttt gaa aaa caa ata gat gat atg ttg gat caa        347
Gly Ile Ala Tyr His Phe Glu Lys Gln Ile Asp Asp Met Leu Asp Gln
                85                  90                  95

ttt tac aaa gca gat cct aac ttt gag gct cac gag tac aat gat tta        395
Phe Tyr Lys Ala Asp Pro Asn Phe Glu Ala His Glu Tyr Asn Asp Leu
            100                 105                 110

caa act tta tcc gtt caa ttt cga cta ttg aga caa cat ggt tac aat        443
Gln Thr Leu Ser Val Gln Phe Arg Leu Leu Arg Gln His Gly Tyr Asn
            115                 120                 125

atc tcc cca aaa ctt ttt att aga ttc caa gat gca aaa ggc aaa ttt        491
Ile Ser Pro Lys Leu Phe Ile Arg Phe Gln Asp Ala Lys Gly Lys Phe
130                 135                 140                 145

aaa gaa tct ctt tgt aac gac atc aag ggt ctt ttg aac tta tac gaa        539
Lys Glu Ser Leu Cys Asn Asp Ile Lys Gly Leu Leu Asn Leu Tyr Glu
                150                 155                 160

gcc tcg cat gta agg act cat gga gaa gat att ttg gaa gag gca ctt        587
Ala Ser His Val Arg Thr His Gly Glu Asp Ile Leu Glu Glu Ala Leu
                165                 170                 175

gct ttc tct act gct cat ctt gaa tct gca gct cca cat ttg aag tca        635
Ala Phe Ser Thr Ala His Leu Glu Ser Ala Ala Pro His Leu Lys Ser
            180                 185                 190

cct ctg agt aag caa gtg aca cat gcc ctt gag caa tct ctc cat aag        683
Pro Leu Ser Lys Gln Val Thr His Ala Leu Glu Gln Ser Leu His Lys
            195                 200                 205

agc att cca aga gtt gag aca cgc tac ttc atc tct atc tac gaa gag        731
Ser Ile Pro Arg Val Glu Thr Arg Tyr Phe Ile Ser Ile Tyr Glu Glu
210                 215                 220                 225

gag gaa cag aag aat gat gtg ttg ctt caa ttt gca aaa ctg gac ttc        779
Glu Glu Gln Lys Asn Asp Val Leu Leu Gln Phe Ala Lys Leu Asp Phe
            230                 235                 240

aac tta ctt cag atg ttg cac aaa caa gaa ctt agt gaa gta tca agg        827
Asn Leu Leu Gln Met Leu His Lys Gln Glu Leu Ser Glu Val Ser Arg
            245                 250                 255

tgg tgg aaa gat ttg gat ttt gtg aca aca ctt cca tat gct agg gat        875
Trp Trp Lys Asp Leu Asp Phe Val Thr Thr Leu Pro Tyr Ala Arg Asp
            260                 265                 270

aga gca gtg gaa tgc tac ttt tgg acg atg ggg gtg tat gct gaa cct        923
Arg Ala Val Glu Cys Tyr Phe Trp Thr Met Gly Val Tyr Ala Glu Pro
            275                 280                 285

caa tac tct cag gct cgt gtc atg ctt gct aag act ata gca atg att        971
```

```
Gln Tyr Ser Gln Ala Arg Val Met Leu Ala Lys Thr Ile Ala Met Ile
290             295             300             305

tct ata gta gat gac aca ttc gat gct tat ggc att gtc aaa gaa ctt        1019
Ser Ile Val Asp Asp Thr Phe Asp Ala Tyr Gly Ile Val Lys Glu Leu
            310             315             320

gag atc tac acc gat gcc ata cag agg tgg gat att agc caa att gat        1067
Glu Ile Tyr Thr Asp Ala Ile Gln Arg Trp Asp Ile Ser Gln Ile Asp
            325             330             335

cgg ctc cct gat tac atg aaa atc agt tac aaa gca ctt tta gat ctc        1115
Arg Leu Pro Asp Tyr Met Lys Ile Ser Tyr Lys Ala Leu Leu Asp Leu
            340             345             350

tac aat gat tat gaa atg gag ttg tcc aag gat ggt aga tct gat gtt        1163
Tyr Asn Asp Tyr Glu Met Glu Leu Ser Lys Asp Gly Arg Ser Asp Val
    355             360             365

gtt cac tac gcg aaa gaa aga atg aaa gaa atc gtg aga aac tat ttt        1211
Val His Tyr Ala Lys Glu Arg Met Lys Glu Ile Val Arg Asn Tyr Phe
370             375             380             385

gtg gaa gca aaa tgg ttc att gaa gga tat atg ccg cca gtc tct gag        1259
Val Glu Ala Lys Trp Phe Ile Glu Gly Tyr Met Pro Pro Val Ser Glu
            390             395             400

tat ctt agc aat gca tta gct acc agc act tat tac ttg ctt acg act        1307
Tyr Leu Ser Asn Ala Leu Ala Thr Ser Thr Tyr Tyr Leu Leu Thr Thr
            405             410             415

aca tct tat ttg ggc atg aag tct gct aac aag caa gat ttt gaa tgg        1355
Thr Ser Tyr Leu Gly Met Lys Ser Ala Asn Lys Gln Asp Phe Glu Trp
            420             425             430

ttg gcc aag aac cct aaa att ctt gag gct aat gtg acg tta tgc cga        1403
Leu Ala Lys Asn Pro Lys Ile Leu Glu Ala Asn Val Thr Leu Cys Arg
    435             440             445

gtc ata gat gac ata gcc acc tat gag gtt gag aag ggt aga ggt cag        1451
Val Ile Asp Asp Ile Ala Thr Tyr Glu Val Glu Lys Gly Arg Gly Gln
450             455             460             465

att gcc act gga att gaa tgt tac atg aga gat tat ggt gta tcc aca        1499
Ile Ala Thr Gly Ile Glu Cys Tyr Met Arg Asp Tyr Gly Val Ser Thr
            470             475             480

gaa aag gcc atg gaa aaa ttc caa gaa atg gct gag aca gca tgg aag        1547
Glu Lys Ala Met Glu Lys Phe Gln Glu Met Ala Glu Thr Ala Trp Lys
            485             490             495

gat gta aat gaa gga atc ctt cga cca act ccc gtc tct aca gag att        1595
Asp Val Asn Glu Gly Ile Leu Arg Pro Thr Pro Val Ser Thr Glu Ile
    500             505             510

ctc act cgc att ctc aat ctt gct cgc att atc gat gtt act tat aag        1643
Leu Thr Arg Ile Leu Asn Leu Ala Arg Ile Ile Asp Val Thr Tyr Lys
```

```
              515                      520                       525
    cac aat caa gat gga tac act cat ccg gaa aaa gta cta aaa cct cat    1691
    His Asn Gln Asp Gly Tyr Thr His Pro Glu Lys Val Leu Lys Pro His
    530                     535                 540                 545

    att att gcg ttg ttg gtg gac tct att gaa att taa atcatcgatt         1737
    Ile Ile Ala Leu Leu Val Asp Ser Ile Glu Ile
                        550                 555

    gttttgtaca tctgggagca cttgcttccc atcccctaaa attataagta tttgattgat   1797
    gccttgttgg tatctatgct gctaggcgct agctaagata ggagttgctg gagatacatg   1857
    ttatagtgca gtgcagttaa ttccttaatt ttttttgta tcattattga cattttaaat    1917
    atatatatat atcactgc tttttat                                         1944
```

<210> 32
<211> 556
<212> PRT
<213> Solanum tuberosum

<400> 32

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    Met Thr Pro Ala Ala Val Val Met Ser Asn Tyr Gly Glu Glu Glu Ile
    1               5                   10                  15
    Val Arg Pro Ile Ala Asp Phe Ser Pro Ser Leu Trp Gly Asp Arg Phe
                20                  25                  30
    His Ser Phe Ser Leu Asp Asn Gln Ile Ala Gly Lys Tyr Ala Gln Glu
            35                  40                  45
    Ile Glu Thr Leu Lys Glu Gln Ser Arg Ile Ile Leu Ser Ala Ser Ser
        50                  55                  60
    Arg Arg Thr Leu Ala Glu Lys Leu Asp Leu Ile Asp Ile Val Glu Arg
    65                  70                  75                  80
    Leu Gly Ile Ala Tyr His Phe Glu Lys Gln Ile Asp Asp Met Leu Asp
                    85                  90                  95
    Gln Phe Tyr Lys Ala Asp Pro Asn Phe Glu Ala His Glu Tyr Asn Asp
                100                 105                 110
    Leu Gln Thr Leu Ser Val Gln Phe Arg Leu Leu Arg Gln His Gly Tyr
            115                 120                 125
    Asn Ile Ser Pro Lys Leu Phe Ile Arg Phe Gln Asp Ala Lys Gly Lys
    130                 135                 140
    Phe Lys Glu Ser Leu Cys Asn Asp Ile Lys Gly Leu Leu Asn Leu Tyr
    145                 150                 155                 160
    Glu Ala Ser His Val Arg Thr His Gly Glu Asp Ile Leu Glu Glu Ala
                165                 170                 175
    Leu Ala Phe Ser Thr Ala His Leu Glu Ser Ala Ala Pro His Leu Lys
                180                 185                 190
    Ser Pro Leu Ser Lys Gln Val Thr His Ala Leu Glu Gln Ser Leu His
            195                 200                 205
    Lys Ser Ile Pro Arg Val Glu Thr Arg Tyr Phe Ile Ser Ile Tyr Glu
        210                 215                 220
    Glu Glu Glu Gln Lys Asn Asp Val Leu Leu Gln Phe Ala Lys Leu Asp
    225                 230                 235                 240
    Phe Asn Leu Leu Gln Met Leu His Lys Gln Glu Leu Ser Glu Val Ser
                    245                 250                 255
    Arg Trp Trp Lys Asp Leu Asp Phe Val Thr Thr Leu Pro Tyr Ala Arg
                260                 265                 270
    Asp Arg Ala Val Glu Cys Tyr Phe Trp Thr Met Gly Val Tyr Ala Glu
            275                 280                 285
```

```
Pro Gln Tyr Ser Gln Ala Arg Val Met Leu Ala Lys Thr Ile Ala Met
    290                 295                 300
Ile Ser Ile Val Asp Asp Thr Phe Asp Ala Tyr Gly Ile Val Lys Glu
305                 310                 315                 320
Leu Glu Ile Tyr Thr Asp Ala Ile Gln Arg Trp Asp Ile Ser Gln Ile
                325                 330                 335
Asp Arg Leu Pro Asp Tyr Met Lys Ile Ser Tyr Lys Ala Leu Leu Asp
            340                 345                 350
Leu Tyr Asn Asp Tyr Glu Met Glu Leu Ser Lys Asp Gly Arg Ser Asp
        355                 360                 365
Val Val His Tyr Ala Lys Glu Arg Met Lys Glu Ile Val Arg Asn Tyr
    370                 375                 380
Phe Val Glu Ala Lys Trp Phe Ile Glu Gly Tyr Met Pro Pro Val Ser
385                 390                 395                 400
Glu Tyr Leu Ser Asn Ala Leu Ala Thr Ser Thr Tyr Tyr Leu Leu Thr
                405                 410                 415
Thr Thr Ser Tyr Leu Gly Met Lys Ser Ala Asn Lys Gln Asp Phe Glu
            420                 425                 430
Trp Leu Ala Lys Asn Pro Lys Ile Leu Glu Ala Asn Val Thr Leu Cys
        435                 440                 445
Arg Val Ile Asp Asp Ile Ala Thr Tyr Glu Val Glu Lys Gly Arg Gly
    450                 455                 460
Gln Ile Ala Thr Gly Ile Glu Cys Tyr Met Arg Asp Tyr Gly Val Ser
465                 470                 475                 480
Thr Glu Lys Ala Met Glu Lys Phe Gln Glu Met Ala Glu Thr Ala Trp
                485                 490                 495
Lys Asp Val Asn Glu Gly Ile Leu Arg Pro Thr Pro Val Ser Thr Glu
                500                 505                 510
Ile Leu Thr Arg Ile Leu Asn Leu Ala Arg Ile Ile Asp Val Thr Tyr
            515                 520                 525
Lys His Asn Gln Asp Gly Tyr Thr His Pro Glu Lys Val Leu Lys Pro
    530                 535                 540
His Ile Ile Ala Leu Leu Val Asp Ser Ile Glu Ile
545                 550                 555
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<210> 33
<211> 3950
<212> DNA
<213> Gossypium arboreum

<220>
<221> CDS
<222> (1457)...(1579)
<223> cadinene synthase

<221> CDS
<222> (1670)...(1939)

<221> CDS
<222> (2092)...(2466)

<221> CDS
<222> (2559)...(2774)

<221> CDS
<222> (2963)...(3103)

<221> CDS
<222> (3206)...(3454)

<221> CDS
<222> (3596)...(3886)

<400> 33
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aatttaactt ttattaattt aaaatttaaa gatttcaaag gggttctaaa atggaaattt      60
ttcgatttta agggaattgt gccagcccct agtttcgccc ttgtttgtag tgctttatt     120
taaaaaagta aatataatag aatatgtata tatatatata tataaaccaa agtgaaagat     180
gaaaatttat ataaatgatc gctgcaagct tcaagctcac aataatatga ttctttacca     240
tcaagaaaca ttggtgcttt atacagagaa aagaaaaact ttggtcctcc tcgtagctaa     300
tattttaaca atttaatttt tatataataa attttaaca attatttcat attttttaaa     360
tatattcatg ttgaatgtag cagtatatag ttatattagt tatgctcata aattttggat     420
gcattagatt ttccttatgt aatttgataa caatgattat tatttttact tctaacaaat     480
aattaaatat ttttttgttg attcgataaa tatcattatt ttttaaatga tttaaaatat     540
aaaaataata atagattcga ccgaacgctc accctattga gtgagtatat caattattag     600
aatttaatta aaaaaggaaa ccaaatatag ccggcttaat tttgtttaat attaatttat     660
gtgtggaaat tcacttaaaa acagagtcca tggctgctaa catattatat attaaaccat     720
ttcctattaa taaatttatg aacgagagtt acatccttct aaattcattt tacttagagg     780
cggagtataa tatttttatgt agtagttatt cttttactat ataaataaat aaataaaatt     840
ttaatcgcct gtgtattatg attgattcag ctgaatcaaa gttggaataa tattttaatt     900
tgggatccca attaattgag attggtttga ttttgggttg taaatatttt ttattaattt     960
tagataaatt attggaagtt ggagtcaaaa ttgaccgtct cagctaatta tacaaataat    1020
aataatatag agaaatgggt atattgctca acactcacat ttactacgtc agcaatagtc    1080
agacagactg ctaagtaaac aatgtacact caattcgagt caaacaaatc ctttatccca    1140
agattctaaa ataatgtgtt tgaggcacca attttgaagg atagaaagtg aaacaaaca    1200
aaaggatatt aaaaaacaag gaaatttctc actgtatttg catatttttc tccttccagt    1260
ataattaaaa tacgtgcaat ttacgttgta ctttgttgac tcctatctta tacctataaa    1320
tacatgcaac aattgcacac atcgtctcat ccaaaacctg tgttttaaac actaaacagt    1380
aagcaaaggc agcaaattaa tctttgaatt atttgcttcc aaaaccctac actttttcctt    1440
caacacatcc tagaaa atg gct tca caa gct tct caa gtt ctt gct tca ccc    1492
                   Met Ala Ser Gln Ala Ser Gln Val Leu Ala Ser Pro
                    1               5                  10

cat ccc gcc att tca tcc gaa aat cga ccc aag gct gat ttt cat ccc    1540
His Pro Ala Ile Ser Ser Glu Asn Arg Pro Lys Ala Asp Phe His Pro
            15              20              25

ggt att tgg ggt gat atg ttc atc atc tgt cct gat acg gtaatctata    1589
Gly Ile Trp Gly Asp Met Phe Ile Ile Cys Pro Asp Thr
        30              35              40

attttttct tactttctct tttatcgatt tttaagtttt ttggagattt catggaaaag    1649
cattatacgt acttgagcag gat atc gat gct gca act gaa tta caa tat gaa    1702
                      Asp Ile Asp Ala Ala Thr Glu Leu Gln Tyr Glu
                           45                  50

gaa tta aaa gca caa gtg agg aag atg att atg gaa cct gtt gat gat    1750
Glu Leu Lys Ala Gln Val Arg Lys Met Ile Met Glu Pro Val Asp Asp
        55              60              65

tca aac caa aag ttg ccc ttc att gat gct gtt caa aga tta ggt gtg    1798
Ser Asn Gln Lys Leu Pro Phe Ile Asp Ala Val Gln Arg Leu Gly Val
    70              75              80

agt tat cat ttt gag aaa gag att gaa gat gaa cta gag aat att tac    1846
Ser Tyr His Phe Glu Lys Glu Ile Glu Asp Glu Leu Glu Asn Ile Tyr
```

```
        Ser Tyr His Phe Glu Lys Glu Ile Glu Asp Glu Leu Glu Asn Ile Tyr
        85              90              95             100

        cgt gac acc aac aac aat gat gcg gac acc gat ctc tac act aca gct    1894
        Arg Asp Thr Asn Asn Asn Asp Ala Asp Thr Asp Leu Tyr Thr Thr Ala
                    105             110             115

        ctt cga ttc cgg tta ctt aga gag cat ggc ttc gat att tct tgt        1939
        Leu Arg Phe Arg Leu Leu Arg Glu His Gly Phe Asp Ile Ser Cys
                    120             125             130

        ggtaattaag tcttaaactt tcataactct tcttatccat ttatcaatta atattatcaa   1999
        actttacatt aataatcatc tgtacaatac ttcaatatat atatatttat tgatgaaact   2059
        aatgtttgat gatgattttg ggtgcttgac ca gat gca ttc aac aag ttc aaa     2112
                                          Asp Ala Phe Asn Lys Phe Lys
                                              135

        gat gag gca ggg aac ttc aag gca tca ttg aca agt gat gtg caa ggg    2160
        Asp Glu Ala Gly Asn Phe Lys Ala Ser Leu Thr Ser Asp Val Gln Gly
            140             145             150

        ttg ttg gaa ctt tat gaa gct tcc tat atg agg gtc cat ggg gaa gat    2208
        Leu Leu Glu Leu Tyr Glu Ala Ser Tyr Met Arg Val His Gly Glu Asp
        155             160             165             170

        ata ctt gat gaa gcc att tct ttc acc act gct caa ctt aca ctt gct    2256
        Ile Leu Asp Glu Ala Ile Ser Phe Thr Thr Ala Gln Leu Thr Leu Ala
                        175             180             185

        cta cca act tta cac cat cct tta tcg gaa cag gtc ggc cat gcc tta    2304
        Leu Pro Thr Leu His His Pro Leu Ser Glu Gln Val Gly His Ala Leu
                    190             195             200

        aag cag tct atc cga agg ggc ttg cca agg gtt gag gcc cgg aat ttc    2352
        Lys Gln Ser Ile Arg Arg Gly Leu Pro Arg Val Glu Ala Arg Asn Phe
                205             210             215

        att tcg ata tac caa gat tta gaa tcc cat aac aaa tcg ttg ctt caa    2400
        Ile Ser Ile Tyr Gln Asp Leu Glu Ser His Asn Lys Ser Leu Leu Gln
            220             225             230

        ttt gca aag att gat ttc aac ttg ttg cag ctt ttg cat agg aaa gag    2448
        Phe Ala Lys Ile Asp Phe Asn Leu Leu Gln Leu Leu His Arg Lys Glu
        235             240             245             250

        cta agt gag atc tgc agg taagtgtttg gagatcttta aagctatgaa           2496
        Leu Ser Glu Ile Cys Arg
                        255

        gtctaatact atttcaattg atcacacgac tgttgctgac attttatgat gctttttta   2556
        gg tgg tgg aaa gat tta gac ttt aca aga aaa cta cca ttt gca aga     2603
           Trp Trp Lys Asp Leu Asp Phe Thr Arg Lys Leu Pro Phe Ala Arg
                   260             265             270

        gat aga gtg gtt gaa ggc tat ttt tgg ata atg gga gtt tac ttt gaa    2651
        Asp Arg Val Val Glu Gly Tyr Phe Trp Ile Met Gly Val Tyr Phe Glu
                275             280             285
```

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ccc caa tac tct ctt ggt aga aag atg ttg aca aaa gtc ata gca atg        2699
Pro Gln Tyr Ser Leu Gly Arg Lys Met Leu Thr Lys Val Ile Ala Met
        290                 295                 300

gct tcc att gtt gat gat act tat gat tca tat gca acc tat gat gaa        2747
Ala Ser Ile Val Asp Asp Thr Tyr Asp Ser Tyr Ala Thr Tyr Asp Glu
        305                 310                 315

ctc att ccc tat aca aat gca att gaa ggtgagattt tttttccttt            2794
Leu Ile Pro Tyr Thr Asn Ala Ile Glu
320                 325

cctccaaaaa aaaaaaaagt ttttgagatc ccccaagaat aggggaaaat atatgttttt     2854
aaacgttagg atattcactc caacttgcag ttgctcatat tttaatggtg atagtatgaa     2914
ctaaccaggc taagttttag attcaaatta accctgaaat tgtgtttt agg tgg gat      2971
                                                         Arg Trp Asp
                                                             330

att aaa tgc atg aac caa ctc ccg aat tac atg aaa ata agc tac aag       3019
Ile Lys Cys Met Asn Gln Leu Pro Asn Tyr Met Lys Ile Ser Tyr Lys
        335                 340                 345

gca cta tta gat gtt tat gaa gaa atg gaa cag ctg ttg gca aat caa       3067
Ala Leu Leu Asp Val Tyr Glu Glu Met Glu Gln Leu Leu Ala Asn Gln
        350                 355                 360

ggg aga cag tac cga gtt gag tat gcg aaa aag gcg gtatgtaatg            3113
Gly Arg Gln Tyr Arg Val Glu Tyr Ala Lys Lys Ala
        365                 370                 375

atacaatagt atgatatgct ttaatcataa acgtataaaa tttgaaaatt acattagcaa     3173
tttgcttact tttttatgcc tttaatcctc ag atg ata cgt ctt gtt caa gct      3226
                                    Met Ile Arg Leu Val Gln Ala
                                        380

tac ctt ttg gag gcc aaa tgg act cat caa aat tat aaa cca acc ttt       3274
Tyr Leu Leu Glu Ala Lys Trp Thr His Gln Asn Tyr Lys Pro Thr Phe
        385                 390                 395

gag gaa ttt aga gat aat gca ttg cca acc tct ggc tat gcc atg ctt       3322
Glu Glu Phe Arg Asp Asn Ala Leu Pro Thr Ser Gly Tyr Ala Met Leu
        400                 405                 410

gct ata acg gcg ttt gtc ggc atg ggc gaa gtt ata acc cct gag acc       3370
Ala Ile Thr Ala Phe Val Gly Met Gly Glu Val Ile Thr Pro Glu Thr
415                 420                 425                 430

ttc aaa tgg gcc gcc agt gac ccc aag atc att aag gct tcc acc att       3418
Phe Lys Trp Ala Ala Ser Asp Pro Lys Ile Ile Lys Ala Ser Thr Ile
                435                 440                 445

att tgc agg ttc atg gac gat att gct gaa cat aag gtatactata           3464
Ile Cys Arg Phe Met Asp Asp Ile Ala Glu His Lys
        450                 455

tattcatatt caagaattct aaaaatcgat tatggtatat atatgcactt aaatctatat     3524
```

```
catagaattg taaggcttct agggtttgca tttgctaagt taattaatat acatggttca        3584
tatgggtgca g ttc aac cat agg aga gaa gac gat tgc tca gcg atc gaa         3634
             Phe Asn His Arg Arg Glu Asp Asp Cys Ser Ala Ile Glu
                 460                 465                 470

tgt tac atg aaa caa tat ggg gtg aca gcg cag gaa gca tac aat gaa          3682
Cys Tyr Met Lys Gln Tyr Gly Val Thr Ala Gln Glu Ala Tyr Asn Glu
            475                 480                 485

ttc aac aaa cac att gag agt tca tgg aaa gat gta aat gaa gag ttc          3730
Phe Asn Lys His Ile Glu Ser Ser Trp Lys Asp Val Asn Glu Glu Phe
            490                 495                 500

ttg aaa ccg aca gaa atg ccg aca ccc gtt ctt tgt cgt agc ctc aac          3778
Leu Lys Pro Thr Glu Met Pro Thr Pro Val Leu Cys Arg Ser Leu Asn
    505                 510                 515

ctt gct agg gtt atg gat gta ctt tac aga gaa ggt gac ggt tat aca          3826
Leu Ala Arg Val Met Asp Val Leu Tyr Arg Glu Gly Asp Gly Tyr Thr
520                 525                 530                 535

cat gtt ggg aaa gct gct aaa ggt ggg atc act tca tta ttg att gat          3874
His Val Gly Lys Ala Ala Lys Gly Gly Ile Thr Ser Leu Leu Ile Asp
                540                 545                 550

cca ata caa att tga aattcaacat tggcttaaga tttactatga gataaaatta          3929
Pro Ile Gln Ile
                555

ataaggtttg tacaatgaag g                                                  3950
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<210> 34
<211> 41
<212> PRT
<213> Gossypium arboreum

<400> 34

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Met Ala Ser Gln Ala Ser Gln Val Leu Ala Ser Pro His Pro Ala Ile
1               5                   10                  15
Ser Ser Glu Asn Arg Pro Lys Ala Asp Phe His Pro Gly Ile Trp Gly
            20                  25                  30
Asp Met Phe Ile Ile Cys Pro Asp Thr
        35                  40
```

<210> 35
<211> 90
<212> PRT
<213> Gossypium arboreum

<400> 35

```
Asp Ile Asp Ala Ala Thr Glu Leu Gln Tyr Glu Glu Leu Lys Ala Gln
1               5                   10                  15
Val Arg Lys Met Ile Met Glu Pro Val Asp Asp Ser Asn Gln Lys Leu
            20                  25                  30
Pro Phe Ile Asp Ala Val Gln Arg Leu Gly Val Ser Tyr His Phe Glu
        35                  40                  45
Lys Glu Ile Glu Asp Glu Leu Glu Asn Ile Tyr Arg Asp Thr Asn Asn
```

```
     50                    55                    60
Asn Asp Ala Asp Thr Asp Leu Tyr Thr Thr Ala Leu Arg Phe Arg Leu
65                    70                    75                    80
Leu Arg Glu His Gly Phe Asp Ile Ser Cys
                85                    90
```

<210> 36
<211> 125
<212> PRT
<213> Gossypium arboreum

<400> 36
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Asp Ala Phe Asn Lys Phe Lys Asp Glu Ala Gly Asn Phe Lys Ala Ser
 1               5                  10                  15
Leu Thr Ser Asp Val Gln Gly Leu Leu Glu Leu Tyr Glu Ala Ser Tyr
            20                  25                  30
Met Arg Val His Gly Glu Asp Ile Leu Asp Glu Ala Ile Ser Phe Thr
            35                  40                  45
Thr Ala Gln Leu Thr Leu Ala Leu Pro Thr Leu His His Pro Leu Ser
        50                  55                  60
Glu Gln Val Gly His Ala Leu Lys Gln Ser Ile Arg Arg Gly Leu Pro
65                  70                  75                  80
Arg Val Glu Ala Arg Asn Phe Ile Ser Ile Tyr Gln Asp Leu Glu Ser
                85                  90                  95
His Asn Lys Ser Leu Leu Gln Phe Ala Lys Ile Asp Phe Asn Leu Leu
            100                 105                 110
Gln Leu Leu His Arg Lys Glu Leu Ser Glu Ile Cys Arg
            115                 120                 125
```

<210> 37
<211> 72
<212> PRT
<213> Gossypium arboreum

<400> 37
```
Trp Trp Lys Asp Leu Asp Phe Thr Arg Lys Leu Pro Phe Ala Arg Asp
 1               5                  10                  15
Arg Val Val Glu Gly Tyr Phe Trp Ile Met Gly Val Tyr Phe Glu Pro
            20                  25                  30
Gln Tyr Ser Leu Gly Arg Lys Met Leu Thr Lys Val Ile Ala Met Ala
            35                  40                  45
Ser Ile Val Asp Asp Thr Tyr Asp Ser Tyr Ala Thr Tyr Asp Glu Leu
        50                  55                  60
Ile Pro Tyr Thr Asn Ala Ile Glu
65                  70
```

<210> 38
<211> 47
<212> PRT
<213> Gossypium arboreum

<400> 38
```
Arg Trp Asp Ile Lys Cys Met Asn Gln Leu Pro Asn Tyr Met Lys Ile
 1               5                  10                  15
Ser Tyr Lys Ala Leu Leu Asp Val Tyr Glu Glu Met Glu Gln Leu Leu
            20                  25                  30
Ala Asn Gln Gly Arg Gln Tyr Arg Val Glu Tyr Ala Lys Lys Ala
```

35   40   45

<210> 39
<211> 83
<212> PRT
<213> Gossypium arboreum

<400> 39
Met Ile Arg Leu Val Gln Ala Tyr Leu Leu Glu Ala Lys Trp Thr His
1   5   10   15
Gln Asn Tyr Lys Pro Thr Phe Glu Glu Phe Arg Asp Asn Ala Leu Pro
            20   25   30
Thr Ser Gly Tyr Ala Met Leu Ala Ile Thr Ala Phe Val Gly Met Gly
            35   40   45
Glu Val Ile Thr Pro Glu Thr Phe Lys Trp Ala Ala Ser Asp Pro Lys
        50   55   60
Ile Ile Lys Ala Ser Thr Ile Ile Cys Arg Phe Met Asp Asp Ile Ala
65   70   75   80
Glu His Lys

<210> 40
<211> 97
<212> PRT
<213> Gossypium arboreum

<400> 40
Phe Asn His Arg Arg Glu Asp Asp Cys Ser Ala Ile Glu Cys Tyr Met
1   5   10   15
Lys Gln Tyr Gly Val Thr Ala Gln Glu Ala Tyr Asn Glu Phe Asn Lys
            20   25   30
His Ile Glu Ser Ser Trp Lys Asp Val Asn Glu Glu Phe Leu Lys Pro
            35   40   45
Thr Glu Met Pro Thr Pro Val Leu Cys Arg Ser Leu Asn Leu Ala Arg
        50   55   60
Val Met Asp Val Leu Tyr Arg Glu Gly Asp Gly Tyr Thr His Val Gly
65   70   75   80
Lys Ala Ala Lys Gly Gly Ile Thr Ser Leu Leu Ile Asp Pro Ile Gln
            85   90   95
Ile

<210> 41
<211> 1994
<212> DNA
<213> Ricinus communis

<220>
<221> CDS
<222> (67)...(1869)
<223> casbene synthase

<400> 41
actcagcagc cgcctctcct accccaatta gcacagaaga tttggtggtt cctctccttg   60
tgaaac atg gca ttg cca tca gct gct atg caa tcc aac cct gaa aag   108
       Met Ala Leu Pro Ser Ala Ala Met Gln Ser Asn Pro Glu Lys
       1   5   10

```
ctt aac tta ttt cac aga ttg tca agc tta ccc acc act agc ttg gaa        156
Leu Asn Leu Phe His Arg Leu Ser Ser Leu Pro Thr Thr Ser Leu Glu
 15              20              25                      30

tat ggc aat aat cgc ttc cct ttc ttt tcc tca tct gcc aag tca cac        204
Tyr Gly Asn Asn Arg Phe Pro Phe Phe Ser Ser Ser Ala Lys Ser His
                35              40                      45

ttt aaa aaa cca act caa gca tgt tta tcc tca aca acc cac caa gaa        252
Phe Lys Lys Pro Thr Gln Ala Cys Leu Ser Ser Thr Thr His Gln Glu
                50              55                      60

gtt cgt cca tta gca tac ttt cct cct act gtc tgg ggc aat cgc ttt        300
Val Arg Pro Leu Ala Tyr Phe Pro Pro Thr Val Trp Gly Asn Arg Phe
            65              70                      75

gct tcc ttg acc ttc aat cca tcg gaa ttt gaa tcg tat gat gaa cgg        348
Ala Ser Leu Thr Phe Asn Pro Ser Glu Phe Glu Ser Tyr Asp Glu Arg
         80              85                      90

gta att gtg ctg aag aaa aaa gtt aag gac ata tta att tca tct aca        396
Val Ile Val Leu Lys Lys Lys Val Lys Asp Ile Leu Ile Ser Ser Thr
 95              100             105                     110

agt gat tca gtg gag acc gtt att tta atc gac tta tta tgt cgg ctt        444
Ser Asp Ser Val Glu Thr Val Ile Leu Ile Asp Leu Leu Cys Arg Leu
                115             120                     125

ggc gta tca tat cac ttt gaa aat gat att gaa gag cta cta agt aaa        492
Gly Val Ser Tyr His Phe Glu Asn Asp Ile Glu Glu Leu Leu Ser Lys
             130             135                     140

atc ttc aac tcc cag cct gac ctt gtc gat gaa aaa gaa tgt gat ctc        540
Ile Phe Asn Ser Gln Pro Asp Leu Val Asp Glu Lys Glu Cys Asp Leu
             145             150                     155

tac act gcg gca att gta ttc cga gtt ttc aga cag cat ggt ttt aaa        588
Tyr Thr Ala Ala Ile Val Phe Arg Val Phe Arg Gln His Gly Phe Lys
         160             165                     170

atg tct tcg gat gtg ttt agc aaa ttc aag gac agt gat ggt aag ttc        636
Met Ser Ser Asp Val Phe Ser Lys Phe Lys Asp Ser Asp Gly Lys Phe
 175             180                     185                 190

aag gaa tcc cta cgg ggt gat gct aag ggt atg ctc agc ctt ttt gaa        684
Lys Glu Ser Leu Arg Gly Asp Ala Lys Gly Met Leu Ser Leu Phe Glu
             195             200                     205

gct tcc cat cta agt gtg cat gga gaa gac att ctt gaa gaa gcc ttt        732
Ala Ser His Leu Ser Val His Gly Glu Asp Ile Leu Glu Glu Ala Phe
             210             215                     220

gct ttc acc aag gat tac tta cag tcc tct gca gtt gag tta ttc cct        780
Ala Phe Thr Lys Asp Tyr Leu Gln Ser Ser Ala Val Glu Leu Phe Pro
         225             230                     235
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aat ctc aaa agg cat ata acg aac gcc cta gag cag cct ttc cac agt      828
Asn Leu Lys Arg His Ile Thr Asn Ala Leu Glu Gln Pro Phe His Ser
    240             245             250

ggc gtg ccg agg cta gag gcc agg aaa ttc atc gat cta tac gaa gct      876
Gly Val Pro Arg Leu Glu Ala Arg Lys Phe Ile Asp Leu Tyr Glu Ala
255             260             265             270

gat att gaa tgc cgg aat gaa act ctg ctc gag ttt gca aag ttg gat      924
Asp Ile Glu Cys Arg Asn Glu Thr Leu Leu Glu Phe Ala Lys Leu Asp
            275             280             285

tat aat aga gtt cag tta ttg cac caa caa gag ctg tgc cag ttc tca      972
Tyr Asn Arg Val Gln Leu Leu His Gln Gln Glu Leu Cys Gln Phe Ser
        290             295             300

aag tgg tgg aaa gac ctg aat ctt gct tcg gat att cct tat gca aga     1020
Lys Trp Trp Lys Asp Leu Asn Leu Ala Ser Asp Ile Pro Tyr Ala Arg
        305             310             315

gac aga atg gca gag att ttc ttt tgg gca gtc gcg atg tac ttt gag     1068
Asp Arg Met Ala Glu Ile Phe Phe Trp Ala Val Ala Met Tyr Phe Glu
    320             325             330

cct gac tat gca cac acc cga atg att att gcg aag gtt gta ttg ctt     1116
Pro Asp Tyr Ala His Thr Arg Met Ile Ile Ala Lys Val Val Leu Leu
335             340             345             350

ata tca cta ata gat gat aca att gat gcg tat gca aca atg gag gaa     1164
Ile Ser Leu Ile Asp Asp Thr Ile Asp Ala Tyr Ala Thr Met Glu Glu
            355             360             365

act cat att ctt gct gaa gca gtc gca agg tgg gac atg agc tgc ctc     1212
Thr His Ile Leu Ala Glu Ala Val Ala Arg Trp Asp Met Ser Cys Leu
        370             375             380

gag aag ctg cca gat tac atg aaa gtt att tat aaa cta ttg cta aac     1260
Glu Lys Leu Pro Asp Tyr Met Lys Val Ile Tyr Lys Leu Leu Leu Asn
        385             390             395

acc ttc tct gaa ttc gag aaa gaa ttg acg gcg gaa ggc aag tcc tac     1308
Thr Phe Ser Glu Phe Glu Lys Glu Leu Thr Ala Glu Gly Lys Ser Tyr
    400             405             410

agc gtc aaa tac gga agg gaa gcg ttt caa gaa cta gtg aga ggt tac     1356
Ser Val Lys Tyr Gly Arg Glu Ala Phe Gln Glu Leu Val Arg Gly Tyr
415             420             425             430

tac ctg gag gct gta tgg cgc gac gag ggt aaa ata cca tcg ttc gat     1404
Tyr Leu Glu Ala Val Trp Arg Asp Glu Gly Lys Ile Pro Ser Phe Asp
            435             440             445

gac tac ttg tat aat gga tcc atg acc acc gga ttg cct ctc gtc tca     1452
Asp Tyr Leu Tyr Asn Gly Ser Met Thr Thr Gly Leu Pro Leu Val Ser
            450             455             460

aca gct tct ttc atg gga gtt caa gaa att aca ggt ctc aac gaa ttc     1500
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```
        Thr Ala Ser Phe Met Gly Val Gln Glu Ile Thr Gly Leu Asn Glu Phe
                465                 470             475

        caa tgg ctg gaa act aat ccc aaa tta agt tat gct tcc ggt gca ttc    1548
        Gln Trp Leu Glu Thr Asn Pro Lys Leu Ser Tyr Ala Ser Gly Ala Phe
            480                 485             490

        atc cga ctt gtc aac gac tta act tct cat gtg act gaa caa caa aga    1596
        Ile Arg Leu Val Asn Asp Leu Thr Ser His Val Thr Glu Gln Gln Arg
        495                 500             505                 510

        gga cac gtt gca tct tgc atc gac tgc tat atg aac caa cat gga gtt    1644
        Gly His Val Ala Ser Cys Ile Asp Cys Tyr Met Asn Gln His Gly Val
                        515             520             525

        tcc aaa gac gaa gca gtc aaa ata ctt caa aaa atg gct aca gat tgt    1692
        Ser Lys Asp Glu Ala Val Lys Ile Leu Gln Lys Met Ala Thr Asp Cys
                    530             535             540

        tgg aaa gaa att aat gaa gaa tgt atg agg cag agt caa gtg tca gtg    1740
        Trp Lys Glu Ile Asn Glu Glu Cys Met Arg Gln Ser Gln Val Ser Val
                545             550             555

        ggt cac cta atg aga ata gtt aat ctg gca cgt ctt acg gat gtg agt    1788
        Gly His Leu Met Arg Ile Val Asn Leu Ala Arg Leu Thr Asp Val Ser
            560             565             570

        tac aag tat gga gac ggt tac act gat tcc cag caa ttg aaa caa ttt    1836
        Tyr Lys Tyr Gly Asp Gly Tyr Thr Asp Ser Gln Gln Leu Lys Gln Phe
        575             580             585             590

        gtt aag gga ttg ttc gtt gat cca att tct att tgaactcaat aattcctttt  1889
        Val Lys Gly Leu Phe Val Asp Pro Ile Ser Ile
                        595             600

        ttcattttgt acttcaataa gttataaatg acccgtgcac tagcggtggt gattattgta   1949
        tttaaattgc cttttaaatt aatatatgaa tcaagaattt tatag                   1994
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<210> 42
<211> 601
<212> PRT
<213> Ricinus communis

<400> 42
        Met Ala Leu Pro Ser Ala Ala Met Gln Ser Asn Pro Glu Lys Leu Asn
        1               5                   10                  15
        Leu Phe His Arg Leu Ser Ser Leu Pro Thr Thr Ser Leu Glu Tyr Gly
                    20                  25                  30
        Asn Asn Arg Phe Pro Phe Phe Ser Ser Ser Ala Lys Ser His Phe Lys
                    35                  40                  45
        Lys Pro Thr Gln Ala Cys Leu Ser Ser Thr Thr His Gln Glu Val Arg
            50                  55                  60
        Pro Leu Ala Tyr Phe Pro Pro Thr Val Trp Gly Asn Arg Phe Ala Ser
        65                  70                  75                  80
        Leu Thr Phe Asn Pro Ser Glu Phe Glu Ser Tyr Asp Glu Arg Val Ile
                        85                  90                  95
        Val Leu Lys Lys Lys Val Lys Asp Ile Leu Ile Ser Ser Thr Ser Asp
```

```
                    100                       105                      110
    Ser Val Glu Thr Val Ile Leu Ile Asp Leu Leu Cys Arg Leu Gly Val
                115                       120                      125
    Ser Tyr His Phe Glu Asn Asp Ile Glu Glu Leu Leu Ser Lys Ile Phe
                130                       135                      140
    Asn Ser Gln Pro Asp Leu Val Asp Glu Lys Glu Cys Asp Leu Tyr Thr
    145                       150                      155                   160
    Ala Ala Ile Val Phe Arg Val Phe Arg Gln His Gly Phe Lys Met Ser
                          165                       170                   175
    Ser Asp Val Phe Ser Lys Phe Lys Asp Ser Asp Gly Lys Phe Lys Glu
                      180                       185                   190
    Ser Leu Arg Gly Asp Ala Lys Gly Met Leu Ser Leu Phe Glu Ala Ser
                195                       200                      205
    His Leu Ser Val His Gly Glu Asp Ile Leu Glu Glu Ala Phe Ala Phe
                210                       215                      220
    Thr Lys Asp Tyr Leu Gln Ser Ser Ala Val Glu Leu Phe Pro Asn Leu
    225                       230                      235                   240
    Lys Arg His Ile Thr Asn Ala Leu Glu Gln Pro Phe His Ser Gly Val
                          245                       250                   255
    Pro Arg Leu Glu Ala Arg Lys Phe Ile Asp Leu Tyr Glu Ala Asp Ile
                      260                       265                   270
    Glu Cys Arg Asn Glu Thr Leu Leu Glu Phe Ala Lys Leu Asp Tyr Asn
                275                       280                      285
    Arg Val Gln Leu Leu His Gln Gln Glu Leu Cys Gln Phe Ser Lys Trp
                290                       295                      300
    Trp Lys Asp Leu Asn Leu Ala Ser Asp Ile Pro Tyr Ala Arg Asp Arg
    305                       310                      315                   320
    Met Ala Glu Ile Phe Phe Trp Ala Val Ala Met Tyr Phe Glu Pro Asp
                          325                       330                   335
    Tyr Ala His Thr Arg Met Ile Ile Ala Lys Val Val Leu Leu Ile Ser
                340                       345                      350
    Leu Ile Asp Asp Thr Ile Asp Ala Tyr Ala Thr Met Glu Glu Thr His
                355                       360                      365
    Ile Leu Ala Glu Ala Val Ala Arg Trp Asp Met Ser Cys Leu Glu Lys
    370                       375                      380
    Leu Pro Asp Tyr Met Lys Val Ile Tyr Lys Leu Leu Leu Asn Thr Phe
    385                       390                      395                   400
    Ser Glu Phe Glu Lys Glu Leu Thr Ala Glu Gly Lys Ser Tyr Ser Val
                          405                       410                   415
    Lys Tyr Gly Arg Glu Ala Phe Gln Glu Leu Val Arg Gly Tyr Tyr Leu
                420                       425                      430
    Glu Ala Val Trp Arg Asp Glu Gly Lys Ile Pro Ser Phe Asp Asp Tyr
                435                       440                      445
    Leu Tyr Asn Gly Ser Met Thr Thr Gly Leu Pro Leu Val Ser Thr Ala
    450                       455                      460
    Ser Phe Met Gly Val Gln Glu Ile Thr Gly Leu Asn Glu Phe Gln Trp
    465                       470                      475                   480
    Leu Glu Thr Asn Pro Lys Leu Ser Tyr Ala Ser Gly Ala Phe Ile Arg
                          485                       490                   495
    Leu Val Asn Asp Leu Thr Ser His Val Thr Glu Gln Gln Arg Gly His
                500                       505                      510
    Val Ala Ser Cys Ile Asp Cys Tyr Met Asn Gln His Gly Val Ser Lys
                515                       520                      525
    Asp Glu Ala Val Lys Ile Leu Gln Lys Met Ala Thr Asp Cys Trp Lys
    530                       535                      540
    Glu Ile Asn Glu Glu Cys Met Arg Gln Ser Gln Val Ser Val Gly His
    545                       550                      555                   560
```

```
Leu Met Arg Ile Val Asn Leu Ala Arg Leu Thr Asp Val Ser Tyr Lys
                565                 570                 575
Tyr Gly Asp Gly Tyr Thr Asp Ser Gln Gln Leu Lys Gln Phe Val Lys
            580                 585                 590
Gly Leu Phe Val Asp Pro Ile Ser Ile
            595                 600
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<210> 43
<211> 2700
<212> DNA
<213> Taxus brevifolia

<220>
<221> CDS
<222> (22)...(2607)
<223> taxadiene synthase

<400> 43

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ttcccctgcc tctctggaga a atg gct cag ctc tca ttt aat gca gcg ctg        51
                         Met Ala Gln Leu Ser Phe Asn Ala Ala Leu
                         1               5                   10

aag atg aac gca ttg ggg aac aag gca atc cac gat cca acg aat tgc        99
Lys Met Asn Ala Leu Gly Asn Lys Ala Ile His Asp Pro Thr Asn Cys
                15                  20                  25

aga gcc aaa tct gag cgc caa atg atg tgg gtt tgc tcc aga tca ggg       147
Arg Ala Lys Ser Glu Arg Gln Met Met Trp Val Cys Ser Arg Ser Gly
            30                  35                  40

cga acc aga gta aaa atg tcg aga gga agt ggt ggt cct ggt cct gtc       195
Arg Thr Arg Val Lys Met Ser Arg Gly Ser Gly Gly Pro Gly Pro Val
            45                  50                  55

gta atg atg agc agc agc act ggc act agc aag gtg gtt tcc gag act       243
Val Met Met Ser Ser Ser Thr Gly Thr Ser Lys Val Val Ser Glu Thr
        60                  65                  70

tcc agt acc att gtg gat gat atc cct cga ctc tcc gcc aat tat cat       291
Ser Ser Thr Ile Val Asp Asp Ile Pro Arg Leu Ser Ala Asn Tyr His
75                  80                  85                  90

ggc gat ctg tgg cac cac aat gtt ata caa act ctg gag aca ccg ttt       339
Gly Asp Leu Trp His His Asn Val Ile Gln Thr Leu Glu Thr Pro Phe
                95                  100                 105

cgt gag agt tct act tac caa gaa cgg gca gat gag ctg gtt gtg aaa       387
Arg Glu Ser Ser Thr Tyr Gln Glu Arg Ala Asp Glu Leu Val Val Lys
            110                 115                 120

att aaa gat atg ttc aat gcg ctc gga gac gga gat atc agt ccg tct       435
Ile Lys Asp Met Phe Asn Ala Leu Gly Asp Gly Asp Ile Ser Pro Ser
            125                 130                 135

gca tac gac act gcg tgg gtg gcg agg ctg gcg acc att tcc tct gat       483
Ala Tyr Asp Thr Ala Trp Val Ala Arg Leu Ala Thr Ile Ser Ser Asp
            140                 145                 150
```

```
gga tct gag aag cca cgg ttt cct cag gcc ctc aac tgg gtt ttc aac     531
Gly Ser Glu Lys Pro Arg Phe Pro Gln Ala Leu Asn Trp Val Phe Asn
155             160             165                     170

aac cag ctc cag gat gga tcg tgg ggt atc gaa tcg cac ttt agt tta     579
Asn Gln Leu Gln Asp Gly Ser Trp Gly Ile Glu Ser His Phe Ser Leu
                175                 180                 185

tgc gat cga ttg ctt aac acg acc aat tct gtt atc gcc ctc tcg gtt     627
Cys Asp Arg Leu Leu Asn Thr Thr Asn Ser Val Ile Ala Leu Ser Val
                190                 195                 200

tgg aaa aca ggg cac agc caa gta caa caa ggt gct gag ttt att gca     675
Trp Lys Thr Gly His Ser Gln Val Gln Gln Gly Ala Glu Phe Ile Ala
        205                 210                 215

gag aat cta aga tta ctc aat gag gaa gat gag ttg tcc ccg gat ttc     723
Glu Asn Leu Arg Leu Leu Asn Glu Glu Asp Glu Leu Ser Pro Asp Phe
    220                 225                 230

caa ata atc ttt cct gct ctg ctg caa aag gca aaa gcg ttg ggg atc     771
Gln Ile Ile Phe Pro Ala Leu Leu Gln Lys Ala Lys Ala Leu Gly Ile
235             240                 245                     250

aat ctt cct tac gat ctt cca ttt atc aaa tat ttg tcg aca aca cgg     819
Asn Leu Pro Tyr Asp Leu Pro Phe Ile Lys Tyr Leu Ser Thr Thr Arg
                255                 260                 265

gaa gcc agg ctt aca gat gtt tct gcg gca gca gac aat att cca gcc     867
Glu Ala Arg Leu Thr Asp Val Ser Ala Ala Ala Asp Asn Ile Pro Ala
                270                 275                 280

aac atg ttg aat gcg ttg gaa ggt ctc gag gaa gtt att gac tgg aac     915
Asn Met Leu Asn Ala Leu Glu Gly Leu Glu Glu Val Ile Asp Trp Asn
        285                 290                 295

aag att atg agg ttt caa agt aaa gat gga tct ttc ctg agc tcc cct     963
Lys Ile Met Arg Phe Gln Ser Lys Asp Gly Ser Phe Leu Ser Ser Pro
    300                 305                 310

gcc tcc act gcc tgt gta ctg atg aat aca ggg gac gaa aaa tgt ttc    1011
Ala Ser Thr Ala Cys Val Leu Met Asn Thr Gly Asp Glu Lys Cys Phe
315             320                 325                     330

act ttt ctc aac aat ctg ctc gac aaa ttc ggc ggc tgc gtg ccc tgt    1059
Thr Phe Leu Asn Asn Leu Leu Asp Lys Phe Gly Gly Cys Val Pro Cys
                335                 340                 345

atg tat tcc atc gat ctg ctg gaa cgc ctt tcg ctg gtt gat aac att    1107
Met Tyr Ser Ile Asp Leu Leu Glu Arg Leu Ser Leu Val Asp Asn Ile
                350                 355                 360

gag cat ctc gga atc ggt cgc cat ttc aaa caa gaa atc aaa gga gct    1155
Glu His Leu Gly Ile Gly Arg His Phe Lys Gln Glu Ile Lys Gly Ala
    365                 370                 375
```

```
ctt gat tat gtc tac aga cat tgg agt gaa agg ggc atc ggt tgg ggc      1203
Leu Asp Tyr Val Tyr Arg His Trp Ser Glu Arg Gly Ile Gly Trp Gly
    380             385             390

aga gac agc ctt gtt cca gat ctc aac acc aca gcc ctc ggc ctg cga      1251
Arg Asp Ser Leu Val Pro Asp Leu Asn Thr Thr Ala Leu Gly Leu Arg
395             400             405             410

act ctt cgc atg cac gga tac aat gtt tct tca gac gtt ttg aat aat      1299
Thr Leu Arg Met His Gly Tyr Asn Val Ser Ser Asp Val Leu Asn Asn
            415             420             425

ttc aaa gat gaa aac ggg cgg ttc ttc tcc tct gcg ggc caa acc cat      1347
Phe Lys Asp Glu Asn Gly Arg Phe Phe Ser Ser Ala Gly Gln Thr His
            430             435             440

gtc gaa ttg aga agc gtg gtg aat ctt ttc aga gct tcc gac ctt gca      1395
Val Glu Leu Arg Ser Val Val Asn Leu Phe Arg Ala Ser Asp Leu Ala
        445             450             455

ttt cct gac gaa aga gct atg gac gat gct aga aaa ttt gca gaa cca      1443
Phe Pro Asp Glu Arg Ala Met Asp Asp Ala Arg Lys Phe Ala Glu Pro
    460             465             470

tat ctt aga gag gca ctt gca acg aaa atc tca acc aat aca aaa cta      1491
Tyr Leu Arg Glu Ala Leu Ala Thr Lys Ile Ser Thr Asn Thr Lys Leu
475             480             485             490

ttc aaa gag att gag tac gtg gtg gag tac cct tgg cac atg agt atc      1539
Phe Lys Glu Ile Glu Tyr Val Val Glu Tyr Pro Trp His Met Ser Ile
            495             500             505

cca cgc tta gaa gcc aga agt tat att gat tca tat gac gac aat tat      1587
Pro Arg Leu Glu Ala Arg Ser Tyr Ile Asp Ser Tyr Asp Asp Asn Tyr
        510             515             520

gta tgg cag agg aag act cta tat aga atg cca tct ttg agt aat tca      1635
Val Trp Gln Arg Lys Thr Leu Tyr Arg Met Pro Ser Leu Ser Asn Ser
        525             530             535

aaa tgt tta gaa ttg gca aaa ttg gac ttc aat atc gta caa tct ttg      1683
Lys Cys Leu Glu Leu Ala Lys Leu Asp Phe Asn Ile Val Gln Ser Leu
    540             545             550

cat caa gag gag ttg aag ctt cta aca aga tgg tgg aag gaa tcc ggc      1731
His Gln Glu Glu Leu Lys Leu Leu Thr Arg Trp Trp Lys Glu Ser Gly
555             560             565             570

atg gca gat ata aat ttc act cga cac cga gtg gcg gag gtt tat ttt      1779
Met Ala Asp Ile Asn Phe Thr Arg His Arg Val Ala Glu Val Tyr Phe
            575             580             585

tca tca gct aca ttt gaa ccc gaa tat tct gcc act aga att gcc ttc      1827
Ser Ser Ala Thr Phe Glu Pro Glu Tyr Ser Ala Thr Arg Ile Ala Phe
        590             595             600

aca aaa att ggt tgt tta caa gtc ctt ttt gat gat atg gct gac atc      1875
```

```
Thr Lys Ile Gly Cys Leu Gln Val Leu Phe Asp Asp Met Ala Asp Ile
    605                 610                 615

ttt gca aca cta gat gaa ttg aaa agt ttc act gag gga gta aag aga    1923
Phe Ala Thr Leu Asp Glu Leu Lys Ser Phe Thr Glu Gly Val Lys Arg
    620                 625                 630

tgg gat aca tct ttg cta cat gag att cca gag tgt atg caa act tgc    1971
Trp Asp Thr Ser Leu Leu His Glu Ile Pro Glu Cys Met Gln Thr Cys
635                 640                 645                 650

ttt aaa gtt tgg ttc aaa tta atg gaa gaa gta aat aat gat gtg gtt    2019
Phe Lys Val Trp Phe Lys Leu Met Glu Glu Val Asn Asn Asp Val Val
                655                 660                 665

aag gta caa gga cgt gac atg ctc gct cac ata aga aaa ccc tgg gag    2067
Lys Val Gln Gly Arg Asp Met Leu Ala His Ile Arg Lys Pro Trp Glu
                670                 675                 680

ttg tac ttc aat tgt tat gta caa gaa agg gag tgg ctt gaa gcc ggg    2115
Leu Tyr Phe Asn Cys Tyr Val Gln Glu Arg Glu Trp Leu Glu Ala Gly
                685                 690                 695

tat ata cca act ttt gaa gag tac tta aag act tat gct ata tca gta    2163
Tyr Ile Pro Thr Phe Glu Glu Tyr Leu Lys Thr Tyr Ala Ile Ser Val
    700                 705                 710

ggc ctt gga ccg tgt acc cta caa cca ata cta cta atg ggt gag ctt    2211
Gly Leu Gly Pro Cys Thr Leu Gln Pro Ile Leu Leu Met Gly Glu Leu
715                 720                 725                 730

gtg aaa gat gat gtt gtt gag aaa gtg cac tat ccc tca aat atg ttt    2259
Val Lys Asp Asp Val Val Glu Lys Val His Tyr Pro Ser Asn Met Phe
                735                 740                 745

gag ctt gta tcc ttg agc tgg cga cta aca aac gac acc aaa aca tat    2307
Glu Leu Val Ser Leu Ser Trp Arg Leu Thr Asn Asp Thr Lys Thr Tyr
                750                 755                 760

cag gct gaa aag gct cga gga caa caa gcc tca ggc ata gca tgc tat    2355
Gln Ala Glu Lys Ala Arg Gly Gln Gln Ala Ser Gly Ile Ala Cys Tyr
                765                 770                 775

atg aag gat aat cca gga gca act gag gaa gat gcc att aag cac ata    2403
Met Lys Asp Asn Pro Gly Ala Thr Glu Glu Asp Ala Ile Lys His Ile
    780                 785                 790

tgt cgt gtt gtt gat cgg gcc ttg aaa gaa gca agc ttt gaa tat ttc    2451
Cys Arg Val Val Asp Arg Ala Leu Lys Glu Ala Ser Phe Glu Tyr Phe
795                 800                 805                 810

aaa cca tcc aat gat atc cca atg ggt tgc aag tcc ttt att ttt aac    2499
Lys Pro Ser Asn Asp Ile Pro Met Gly Cys Lys Ser Phe Ile Phe Asn
                815                 820                 825

ctt aga ttg tgt gtc caa atc ttt tac aag ttt ata gat ggg tac gga    2547
Leu Arg Leu Cys Val Gln Ile Phe Tyr Lys Phe Ile Asp Gly Tyr Gly
```

```
          830                   835                   840
atc gcc aat gag gag att aag gac tat ata aga aaa gtt tat att gat      2595
Ile Ala Asn Glu Glu Ile Lys Asp Tyr Ile Arg Lys Val Tyr Ile Asp
        845                   850                   855


cca att caa gta tga tatatcatgt aaaacctctt tttcatgata aattgactta     2650
Pro Ile Gln Val
    860


ttattgtatt ggcaaaaaaa aaaaaaaaaa aaaaaaaaaa aaaaaaaaaa              2700
```

<210> 44
<211> 862
<212> PRT
<213> Taxus brevifolia

<400> 44

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Met Ala Gln Leu Ser Phe Asn Ala Ala Leu Lys Met Asn Ala Leu Gly
 1               5                  10                  15
Asn Lys Ala Ile His Asp Pro Thr Asn Cys Arg Ala Lys Ser Glu Arg
            20                  25                  30
Gln Met Met Trp Val Cys Ser Arg Ser Gly Arg Thr Arg Val Lys Met
        35                  40                  45
Ser Arg Gly Ser Gly Gly Pro Gly Pro Val Val Met Met Ser Ser Ser
    50                  55                  60
Thr Gly Thr Ser Lys Val Val Ser Glu Thr Ser Ser Thr Ile Val Asp
65                  70                  75                  80
Asp Ile Pro Arg Leu Ser Ala Asn Tyr His Gly Asp Leu Trp His His
                85                  90                  95
Asn Val Ile Gln Thr Leu Glu Thr Pro Phe Arg Glu Ser Ser Thr Tyr
            100                 105                 110
Gln Glu Arg Ala Asp Glu Leu Val Val Lys Ile Lys Asp Met Phe Asn
        115                 120                 125
Ala Leu Gly Asp Gly Asp Ile Ser Pro Ser Ala Tyr Asp Thr Ala Trp
    130                 135                 140
Val Ala Arg Leu Ala Thr Ile Ser Ser Asp Gly Ser Glu Lys Pro Arg
145                 150                 155                 160
Phe Pro Gln Ala Leu Asn Trp Val Phe Asn Asn Gln Leu Gln Asp Gly
                165                 170                 175
Ser Trp Gly Ile Glu Ser His Phe Ser Leu Cys Asp Arg Leu Leu Asn
            180                 185                 190
Thr Thr Asn Ser Val Ile Ala Leu Ser Val Trp Lys Thr Gly His Ser
        195                 200                 205
Gln Val Gln Gln Gly Ala Glu Phe Ile Ala Glu Asn Leu Arg Leu Leu
    210                 215                 220
Asn Glu Glu Asp Glu Leu Ser Pro Asp Phe Gln Ile Ile Phe Pro Ala
225                 230                 235                 240
Leu Leu Gln Lys Ala Lys Ala Leu Gly Ile Asn Leu Pro Tyr Asp Leu
                245                 250                 255
Pro Phe Ile Lys Tyr Leu Ser Thr Thr Arg Glu Ala Arg Leu Thr Asp
            260                 265                 270
Val Ser Ala Ala Ala Asp Asn Ile Pro Ala Asn Met Leu Asn Ala Leu
        275                 280                 285
Glu Gly Leu Glu Glu Val Ile Asp Trp Asn Lys Ile Met Arg Phe Gln
    290                 295                 300
Ser Lys Asp Gly Ser Phe Leu Ser Ser Pro Ala Ser Thr Ala Cys Val
```

```
305                    310                    315                    320
Leu Met Asn Thr Gly Asp Glu Lys Cys Phe Thr Phe Leu Asn Asn Leu
                325                    330                    335
Leu Asp Lys Phe Gly Gly Cys Val Pro Cys Met Tyr Ser Ile Asp Leu
                340                    345                    350
Leu Glu Arg Leu Ser Leu Val Asp Asn Ile Glu His Leu Gly Ile Gly
                355                    360                    365
Arg His Phe Lys Gln Glu Ile Lys Gly Ala Leu Asp Tyr Val Tyr Arg
                370                    375                    380
His Trp Ser Glu Arg Gly Ile Gly Trp Gly Arg Asp Ser Leu Val Pro
385                    390                    395                    400
Asp Leu Asn Thr Thr Ala Leu Gly Leu Arg Thr Leu Arg Met His Gly
                405                    410                    415
Tyr Asn Val Ser Ser Asp Val Leu Asn Asn Phe Lys Asp Glu Asn Gly
                420                    425                    430
Arg Phe Phe Ser Ser Ala Gly Gln Thr His Val Glu Leu Arg Ser Val
                435                    440                    445
Val Asn Leu Phe Arg Ala Ser Asp Leu Ala Phe Pro Asp Glu Arg Ala
                450                    455                    460
Met Asp Asp Ala Arg Lys Phe Ala Glu Pro Tyr Leu Arg Glu Ala Leu
465                    470                    475                    480
Ala Thr Lys Ile Ser Thr Asn Thr Lys Leu Phe Lys Glu Ile Glu Tyr
                485                    490                    495
Val Val Glu Tyr Pro Trp His Met Ser Ile Pro Arg Leu Glu Ala Arg
                500                    505                    510
Ser Tyr Ile Asp Ser Tyr Asp Asp Asn Tyr Val Trp Gln Arg Lys Thr
                515                    520                    525
Leu Tyr Arg Met Pro Ser Leu Ser Asn Ser Lys Cys Leu Glu Leu Ala
                530                    535                    540
Lys Leu Asp Phe Asn Ile Val Gln Ser Leu His Gln Glu Glu Leu Lys
545                    550                    555                    560
Leu Leu Thr Arg Trp Trp Lys Glu Ser Gly Met Ala Asp Ile Asn Phe
                565                    570                    575
Thr Arg His Arg Val Ala Glu Val Tyr Phe Ser Ser Ala Thr Phe Glu
                580                    585                    590
Pro Glu Tyr Ser Ala Thr Arg Ile Ala Phe Thr Lys Ile Gly Cys Leu
                595                    600                    605
Gln Val Leu Phe Asp Asp Met Ala Asp Ile Phe Ala Thr Leu Asp Glu
                610                    615                    620
Leu Lys Ser Phe Thr Glu Gly Val Lys Arg Trp Asp Thr Ser Leu Leu
625                    630                    635                    640
His Glu Ile Pro Glu Cys Met Gln Thr Cys Phe Lys Val Trp Phe Lys
                645                    650                    655
Leu Met Glu Glu Val Asn Asn Asp Val Val Lys Val Gln Gly Arg Asp
                660                    665                    670
Met Leu Ala His Ile Arg Lys Pro Trp Glu Leu Tyr Phe Asn Cys Tyr
                675                    680                    685
Val Gln Glu Arg Glu Trp Leu Glu Ala Gly Tyr Ile Pro Thr Phe Glu
                690                    695                    700
Glu Tyr Leu Lys Thr Tyr Ala Ile Ser Val Gly Leu Gly Pro Cys Thr
705                    710                    715                    720
Leu Gln Pro Ile Leu Leu Met Gly Glu Leu Val Lys Asp Asp Val Val
                725                    730                    735
Glu Lys Val His Tyr Pro Ser Asn Met Phe Glu Leu Val Ser Leu Ser
                740                    745                    750
Trp Arg Leu Thr Asn Asp Thr Lys Thr Tyr Gln Ala Glu Lys Ala Arg
                755                    760                    765
```

```
Gly Gln Gln Ala Ser Gly Ile Ala Cys Tyr Met Lys Asp Asn Pro Gly
    770                 775             780
Ala Thr Glu Glu Asp Ala Ile Lys His Ile Cys Arg Val Val Asp Arg
785                 790             795                 800
Ala Leu Lys Glu Ala Ser Phe Glu Tyr Phe Lys Pro Ser Asn Asp Ile
                805             810             815
Pro Met Gly Cys Lys Ser Phe Ile Phe Asn Leu Arg Leu Cys Val Gln
            820             825             830
Ile Phe Tyr Lys Phe Ile Asp Gly Tyr Gly Ile Ala Asn Glu Glu Ile
        835             840             845
Lys Asp Tyr Ile Arg Lys Val Tyr Ile Asp Pro Ile Gln Val
    850                 855             860
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<210> 45
<211> 2424
<212> DNA
<213> Abies grandis

<220>
<221> CDS
<222> (2)...(2347)
<223> E-alpha-bisabolene synthase

<400> 45

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g ggt tat gat ctt gtg cat tct ctt aaa tca cct tat att gat tct agt       49
  Gly Tyr Asp Leu Val His Ser Leu Lys Ser Pro Tyr Ile Asp Ser Ser
  1               5                   10                  15

tac aga gaa cgc gcg gag gtc ctt gtt agc gag att aaa gtg atg ctt       97
Tyr Arg Glu Arg Ala Glu Val Leu Val Ser Glu Ile Lys Val Met Leu
            20                  25                  30

aat cca gct att aca gga gat gga gaa tca atg att act cca tct gct      145
Asn Pro Ala Ile Thr Gly Asp Gly Glu Ser Met Ile Thr Pro Ser Ala
            35                  40                  45

tat gac aca gca tgg gta gcg agg gtg ccc gcc att gat ggc tct gct      193
Tyr Asp Thr Ala Trp Val Ala Arg Val Pro Ala Ile Asp Gly Ser Ala
        50                  55                  60

cgc ccg caa ttt ccc caa aca gtt gac tgg att ttg aaa aac cag tta      241
Arg Pro Gln Phe Pro Gln Thr Val Asp Trp Ile Leu Lys Asn Gln Leu
65                  70                  75                  80

aaa gat ggt tca tgg gga att cag tcc cac ttt ctg ctg tcc gac cgt      289
Lys Asp Gly Ser Trp Gly Ile Gln Ser His Phe Leu Leu Ser Asp Arg
                85                  90                  95

ctt ctt gcc act ctt tct tgt gtt ctt gtg ctc ctt aaa tgg aac gtt      337
Leu Leu Ala Thr Leu Ser Cys Val Leu Val Leu Leu Lys Trp Asn Val
                100                 105                 110

ggg gat ctg caa gta gag cag gga att gaa ttc ata aag agc aat ctg      385
Gly Asp Leu Gln Val Glu Gln Gly Ile Glu Phe Ile Lys Ser Asn Leu
            115                 120                 125

gaa cta gta aag gat gaa acc gat caa gat agc ttg gta aca gac ttt      433
```

```
    Glu Leu Val Lys Asp Glu Thr Asp Gln Asp Ser Leu Val Thr Asp Phe
        130                 135                 140

    gag atc ata ttt cct tct ctg tta aga gaa gct caa tct ctg cgc ctc        481
    Glu Ile Ile Phe Pro Ser Leu Leu Arg Glu Ala Gln Ser Leu Arg Leu
    145                 150                 155                 160

    gga ctt ccc tac gac ctg cct tat ata cat ctg ttg cag act aaa cgg        529
    Gly Leu Pro Tyr Asp Leu Pro Tyr Ile His Leu Leu Gln Thr Lys Arg
                        165                 170                 175

    cag gaa aga tta gca aaa ctt tca agg gag gaa att tat gcg gtt ccg        577
    Gln Glu Arg Leu Ala Lys Leu Ser Arg Glu Glu Ile Tyr Ala Val Pro
                    180                 185                 190

    tcg cca ttg ttg tat tct tta gag gga ata caa gat ata gtt gaa tgg        625
    Ser Pro Leu Leu Tyr Ser Leu Glu Gly Ile Gln Asp Ile Val Glu Trp
                195                 200                 205

    gaa cga ata atg gaa gtt caa agt cag gat ggg tct ttc tta agc tca        673
    Glu Arg Ile Met Glu Val Gln Ser Gln Asp Gly Ser Phe Leu Ser Ser
        210                 215                 220

    cct gct tct act gcc tgc gtt ttc atg cac aca gga gac gcg aaa tgc        721
    Pro Ala Ser Thr Ala Cys Val Phe Met His Thr Gly Asp Ala Lys Cys
    225                 230                 235                 240

    ctt gaa ttc ttg aac agt gtg atg atc aag ttt gga aat ttt gtt ccc        769
    Leu Glu Phe Leu Asn Ser Val Met Ile Lys Phe Gly Asn Phe Val Pro
                        245                 250                 255

    tgc ctg tat cct gtg gat ctg ctg gaa cgc ctg ttg atc gta gat aat        817
    Cys Leu Tyr Pro Val Asp Leu Leu Glu Arg Leu Leu Ile Val Asp Asn
                    260                 265                 270

    att gta cgc ctt gga atc tat aga cac ttt gaa aag gaa atc aag gaa        865
    Ile Val Arg Leu Gly Ile Tyr Arg His Phe Glu Lys Glu Ile Lys Glu
                275                 280                 285

    gct ctt gat tat gtt tac agg cat tgg aac gaa aga gga att ggg tgg        913
    Ala Leu Asp Tyr Val Tyr Arg His Trp Asn Glu Arg Gly Ile Gly Trp
        290                 295                 300

    ggc aga cta aat ccc ata gca gat ctt gag acc act gct ttg gga ttt        961
    Gly Arg Leu Asn Pro Ile Ala Asp Leu Glu Thr Thr Ala Leu Gly Phe
    305                 310                 315                 320

    cga ttg ctt cgg ctg cat agg tac aat gta tct cca gcc att ttt gac       1009
    Arg Leu Leu Arg Leu His Arg Tyr Asn Val Ser Pro Ala Ile Phe Asp
                        325                 330                 335

    aac ttc aaa gat gcc aat ggg aaa ttc att tgc tcg acc ggt caa ttc       1057
    Asn Phe Lys Asp Ala Asn Gly Lys Phe Ile Cys Ser Thr Gly Gln Phe
                    340                 345                 350

    aac aaa gat gta gca agc atg ctg aat ctt tat aga gct tcc cag ctc       1105
    Asn Lys Asp Val Ala Ser Met Leu Asn Leu Tyr Arg Ala Ser Gln Leu
```

```
                355                        360                        365

gca ttt ccc gga gaa aac att ctt gat gaa gct aaa agc ttc gct act        1153
Ala Phe Pro Gly Glu Asn Ile Leu Asp Glu Ala Lys Ser Phe Ala Thr
    370                 375                 380

aaa tat ttg aga gaa gct ctt gag aaa agt gag act tcc agt gca tgg        1201
Lys Tyr Leu Arg Glu Ala Leu Glu Lys Ser Glu Thr Ser Ser Ala Trp
385                 390                 395                 400

aac aac aaa caa aac ctg agc caa gag atc aaa tac gcg ctg aag act        1249
Asn Asn Lys Gln Asn Leu Ser Gln Glu Ile Lys Tyr Ala Leu Lys Thr
                405                 410                 415

tct tgg cat gcc agt gtt ccg aga gtg gaa gca aag aga tac tgt caa        1297
Ser Trp His Ala Ser Val Pro Arg Val Glu Ala Lys Arg Tyr Cys Gln
            420                 425                 430

gtg tat cgc cca gat tat gca cgc ata gca aaa tgc gtt tac aag cta        1345
Val Tyr Arg Pro Asp Tyr Ala Arg Ile Ala Lys Cys Val Tyr Lys Leu
        435                 440                 445

ccc tac gtg aac aat gaa aag ttt tta gag ctg gga aaa tta gat ttc        1393
Pro Tyr Val Asn Asn Glu Lys Phe Leu Glu Leu Gly Lys Leu Asp Phe
    450                 455                 460

aac att atc cag tcc atc cac caa gaa gaa atg aag aat gtt acc agc        1441
Asn Ile Ile Gln Ser Ile His Gln Glu Glu Met Lys Asn Val Thr Ser
465                 470                 475                 480

tgg ttt aga gat tcg ggg ttg cca cta ttc acc ttc gct cgg gag agg        1489
Trp Phe Arg Asp Ser Gly Leu Pro Leu Phe Thr Phe Ala Arg Glu Arg
                485                 490                 495

ccg ctg gaa ttc tac ttc tta gta gcg gcg ggg acc tat gaa ccc cag        1537
Pro Leu Glu Phe Tyr Phe Leu Val Ala Ala Gly Thr Tyr Glu Pro Gln
            500                 505                 510

tat gcc aaa tgc agg ttc ctc ttt aca aaa gtg gca tgc ttg cag act        1585
Tyr Ala Lys Cys Arg Phe Leu Phe Thr Lys Val Ala Cys Leu Gln Thr
        515                 520                 525

gtt ctg gac gat atg tat gac act tat gga acc cta gat gaa ttg aag        1633
Val Leu Asp Asp Met Tyr Asp Thr Tyr Gly Thr Leu Asp Glu Leu Lys
    530                 535                 540

cta ttc act gag gct gtg aga aga tgg gac ctc tcc ttt aca gaa aac        1681
Leu Phe Thr Glu Ala Val Arg Arg Trp Asp Leu Ser Phe Thr Glu Asn
545                 550                 555                 560

ctt cca gac tat atg aaa cta tgt tac caa atc tat tat gac ata gtt        1729
Leu Pro Asp Tyr Met Lys Leu Cys Tyr Gln Ile Tyr Tyr Asp Ile Val
                565                 570                 575

cac gag gtg gct tgg gag gca gag aag gaa cag ggg cgt gaa ttg gtc        1777
His Glu Val Ala Trp Glu Ala Glu Lys Glu Gln Gly Arg Glu Leu Val
            580                 585                 590
```

```
agc ttt ttc aga aag gga tgg gag gat tat ctt ctg ggt tat tat gaa      1825
Ser Phe Phe Arg Lys Gly Trp Glu Asp Tyr Leu Leu Gly Tyr Tyr Glu
        595                 600                 605

gaa gct gaa tgg tta gct gct gag tat gtg cct acc ttg gac gag tac      1873
Glu Ala Glu Trp Leu Ala Ala Glu Tyr Val Pro Thr Leu Asp Glu Tyr
        610                 615                 620

ata aag aat gga atc aca tct atc ggc caa cgt ata ctt ctg ttg agt      1921
Ile Lys Asn Gly Ile Thr Ser Ile Gly Gln Arg Ile Leu Leu Leu Ser
625                 630                 635                 640

gga gtg ttg ata atg gat ggg caa ctc ctt tcg caa gag gca tta gag      1969
Gly Val Leu Ile Met Asp Gly Gln Leu Leu Ser Gln Glu Ala Leu Glu
                645                 650                 655

aaa gta gat tat cca gga aga cgt gtt ctc aca gag ctg aat agc ctc      2017
Lys Val Asp Tyr Pro Gly Arg Arg Val Leu Thr Glu Leu Asn Ser Leu
                660                 665                 670

att tcc cgc ctg gcg gat gac acg aag aca tat aaa gct gag aag gct      2065
Ile Ser Arg Leu Ala Asp Asp Thr Lys Thr Tyr Lys Ala Glu Lys Ala
        675                 680                 685

cgt gga gaa ttg gcg tcc agc att gaa tgt tac atg aaa gac cat cct      2113
Arg Gly Glu Leu Ala Ser Ser Ile Glu Cys Tyr Met Lys Asp His Pro
        690                 695                 700

gaa tgt aca gag gaa gag gct ctc gat cac atc tat agc att ctg gag      2161
Glu Cys Thr Glu Glu Glu Ala Leu Asp His Ile Tyr Ser Ile Leu Glu
705                 710                 715                 720

ccg gcg gtg aag gaa ctg aca aga gag ttt ctg aag ccc gac gac gtc      2209
Pro Ala Val Lys Glu Leu Thr Arg Glu Phe Leu Lys Pro Asp Asp Val
                725                 730                 735

cca ttc gcc tgc aag aag atg ctt ttc gag gag aca aga gtg acg atg      2257
Pro Phe Ala Cys Lys Lys Met Leu Phe Glu Glu Thr Arg Val Thr Met
                740                 745                 750

gtg ata ttc aag gat gga gat gga ttc ggt gtt tcc aaa tta gaa gtc      2305
Val Ile Phe Lys Asp Gly Asp Gly Phe Gly Val Ser Lys Leu Glu Val
        755                 760                 765

aaa gat cat atc aaa gag tgt ctc att gaa ccg ctg cca ctg taa          2350
Lys Asp His Ile Lys Glu Cys Leu Ile Glu Pro Leu Pro Leu
        770                 775                 780

tcaaaatagt tgcaataata attgaaataa tgtcaactat gtttcacaaa aaaaaaaaaa    2410
aaaaaaaaaa aaaa                                                       2424
```

<210> 46
<211> 782
<212> PRT
<213> Abies grandis

<400> 46

```
Gly Tyr Asp Leu Val His Ser Leu Lys Ser Pro Tyr Ile Asp Ser Ser
1               5                   10              15
Tyr Arg Glu Arg Ala Glu Val Leu Val Ser Glu Ile Lys Val Met Leu
        20              25                  30
Asn Pro Ala Ile Thr Gly Asp Gly Glu Ser Met Ile Thr Pro Ser Ala
        35              40                  45
Tyr Asp Thr Ala Trp Val Ala Arg Val Pro Ala Ile Asp Gly Ser Ala
    50              55                  60
Arg Pro Gln Phe Pro Gln Thr Val Asp Trp Ile Leu Lys Asn Gln Leu
65              70              75                  80
Lys Asp Gly Ser Trp Gly Ile Gln Ser His Phe Leu Leu Ser Asp Arg
            85              90                  95
Leu Leu Ala Thr Leu Ser Cys Val Leu Val Leu Leu Lys Trp Asn Val
            100             105                 110
Gly Asp Leu Gln Val Glu Gln Gly Ile Glu Phe Ile Lys Ser Asn Leu
        115             120                 125
Glu Leu Val Lys Asp Glu Thr Asp Gln Asp Ser Leu Val Thr Asp Phe
    130             135                 140
Glu Ile Ile Phe Pro Ser Leu Leu Arg Glu Ala Gln Ser Leu Arg Leu
145             150                 155                 160
Gly Leu Pro Tyr Asp Leu Pro Tyr Ile His Leu Leu Gln Thr Lys Arg
            165             170                 175
Gln Glu Arg Leu Ala Lys Leu Ser Arg Glu Glu Ile Tyr Ala Val Pro
            180             185                 190
Ser Pro Leu Leu Tyr Ser Leu Glu Gly Ile Gln Asp Ile Val Glu Trp
            195             200                 205
Glu Arg Ile Met Glu Val Gln Ser Gln Asp Gly Ser Phe Leu Ser Ser
    210             215                 220
Pro Ala Ser Thr Ala Cys Val Phe Met His Thr Gly Asp Ala Lys Cys
225                 230             235                 240
Leu Glu Phe Leu Asn Ser Val Met Ile Lys Phe Gly Asn Phe Val Pro
            245             250                 255
Cys Leu Tyr Pro Val Asp Leu Leu Glu Arg Leu Leu Ile Val Asp Asn
            260             265                 270
Ile Val Arg Leu Gly Ile Tyr Arg His Phe Glu Lys Glu Ile Lys Glu
        275             280             285
Ala Leu Asp Tyr Val Tyr Arg His Trp Asn Glu Arg Gly Ile Gly Trp
    290             295             300
Gly Arg Leu Asn Pro Ile Ala Asp Leu Glu Thr Thr Ala Leu Gly Phe
305             310             315                 320
Arg Leu Leu Arg Leu His Arg Tyr Asn Val Ser Pro Ala Ile Phe Asp
            325             330                 335
Asn Phe Lys Asp Ala Asn Gly Lys Phe Ile Cys Ser Thr Gly Gln Phe
            340             345                 350
Asn Lys Asp Val Ala Ser Met Leu Asn Leu Tyr Arg Ala Ser Gln Leu
        355             360                 365
Ala Phe Pro Gly Glu Asn Ile Leu Asp Glu Ala Lys Ser Phe Ala Thr
    370             375                 380
Lys Tyr Leu Arg Glu Ala Leu Glu Lys Ser Glu Thr Ser Ser Ala Trp
385             390                 395                 400
Asn Asn Lys Gln Asn Leu Ser Gln Glu Ile Lys Tyr Ala Leu Lys Thr
            405             410                 415
Ser Trp His Ala Ser Val Pro Arg Val Glu Ala Lys Arg Tyr Cys Gln
            420             425                 430
Val Tyr Arg Pro Asp Tyr Ala Arg Ile Ala Lys Cys Val Tyr Lys Leu
            435             440                 445
```

```
Pro Tyr Val Asn Asn Glu Lys Phe Leu Glu Leu Gly Lys Leu Asp Phe
    450             455             460
Asn Ile Ile Gln Ser Ile His Gln Glu Glu Met Lys Asn Val Thr Ser
465             470             475             480
Trp Phe Arg Asp Ser Gly Leu Pro Leu Phe Thr Phe Ala Arg Glu Arg
            485             490             495
Pro Leu Glu Phe Tyr Phe Leu Val Ala Ala Gly Thr Tyr Glu Pro Gln
            500             505             510
Tyr Ala Lys Cys Arg Phe Leu Phe Thr Lys Val Ala Cys Leu Gln Thr
        515             520             525
Val Leu Asp Asp Met Tyr Asp Thr Tyr Gly Thr Leu Asp Glu Leu Lys
    530             535             540
Leu Phe Thr Glu Ala Val Arg Arg Trp Asp Leu Ser Phe Thr Glu Asn
545             550             555             560
Leu Pro Asp Tyr Met Lys Leu Cys Tyr Gln Ile Tyr Tyr Asp Ile Val
            565             570             575
His Glu Val Ala Trp Glu Ala Glu Lys Glu Gln Gly Arg Glu Leu Val
            580             585             590
Ser Phe Phe Arg Lys Gly Trp Glu Asp Tyr Leu Leu Gly Tyr Tyr Glu
            595             600             605
Glu Ala Glu Trp Leu Ala Ala Glu Tyr Val Pro Thr Leu Asp Glu Tyr
            610             615             620
Ile Lys Asn Gly Ile Thr Ser Ile Gly Gln Arg Ile Leu Leu Leu Ser
625             630             635             640
Gly Val Leu Ile Met Asp Gly Gln Leu Leu Ser Gln Glu Ala Leu Glu
            645             650             655
Lys Val Asp Tyr Pro Gly Arg Arg Val Leu Thr Glu Leu Asn Ser Leu
            660             665             670
Ile Ser Arg Leu Ala Asp Asp Thr Lys Thr Tyr Lys Ala Glu Lys Ala
    675             680             685
Arg Gly Glu Leu Ala Ser Ser Ile Glu Cys Tyr Met Lys Asp His Pro
    690             695             700
Glu Cys Thr Glu Glu Glu Ala Leu Asp His Ile Tyr Ser Ile Leu Glu
705             710             715             720
Pro Ala Val Lys Glu Leu Thr Arg Glu Phe Leu Lys Pro Asp Asp Val
            725             730             735
Pro Phe Ala Cys Lys Lys Met Leu Phe Glu Glu Thr Arg Val Thr Met
            740             745             750
Val Ile Phe Lys Asp Gly Asp Gly Phe Gly Val Ser Lys Leu Glu Val
            755             760             765
Lys Asp His Ile Lys Glu Cys Leu Ile Glu Pro Leu Pro Leu
770             775             780
```

<210> 47
<211> 1865
<212> DNA
<213> Abies grandis

<220>
<221> CDS
<222> (1)...(1743)
<223> d-selinene synthase

<400> 47
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atg gct gag att tct gaa tct tcc atc cct cga cgc aca ggg aat cat        48
Met Ala Glu Ile Ser Glu Ser Ser Ile Pro Arg Arg Thr Gly Asn His
  1               5                   10                  15
```

```
cac gga aat gtg tgg gac gat gac ctc ata cac tct ctc aac tcg ccc          96
His Gly Asn Val Trp Asp Asp Asp Leu Ile His Ser Leu Asn Ser Pro
              20                  25                  30

tat ggg gca cct gca tat tat gag ctc ctt caa aag ctt att cag gag         144
Tyr Gly Ala Pro Ala Tyr Tyr Glu Leu Leu Gln Lys Leu Ile Gln Glu
          35                  40                  45

atc aag cat tta ctt ttg act gaa atg gaa atg gat gat ggc gat cat        192
Ile Lys His Leu Leu Leu Thr Glu Met Glu Met Asp Asp Gly Asp His
      50                  55                  60

gat tta atc aaa cgt ctt cag atc gtt gac act ttg gaa tgc ctg gga        240
Asp Leu Ile Lys Arg Leu Gln Ile Val Asp Thr Leu Glu Cys Leu Gly
65                  70                  75                  80

atc gat aga cat ttt gaa cac gaa ata caa aca gct gct tta gat tac        288
Ile Asp Arg His Phe Glu His Glu Ile Gln Thr Ala Ala Leu Asp Tyr
                  85                  90                  95

gtt tac aga tgg tgg aac gaa aaa ggt atc ggg gag gga tca aga gat        336
Val Tyr Arg Trp Trp Asn Glu Lys Gly Ile Gly Glu Gly Ser Arg Asp
              100                 105                 110

tcc ttc agc aaa gat ctg aac gct acg gct tta gga ttt cgc gct ctc        384
Ser Phe Ser Lys Asp Leu Asn Ala Thr Ala Leu Gly Phe Arg Ala Leu
          115                 120                 125

cga ctg cat cga tat aac gta tcg tca ggt gtg ttg aag aat ttc aag        432
Arg Leu His Arg Tyr Asn Val Ser Ser Gly Val Leu Lys Asn Phe Lys
      130                 135                 140

gat gaa aac ggg aag ttc ttc tgc aac ttt act ggt gaa gaa gga aga        480
Asp Glu Asn Gly Lys Phe Phe Cys Asn Phe Thr Gly Glu Glu Gly Arg
145                 150                 155                 160

gga gat aaa caa gtg aga agc atg ttg tcg tta ctt cga gct tca gag        528
Gly Asp Lys Gln Val Arg Ser Met Leu Ser Leu Leu Arg Ala Ser Glu
              165                 170                 175

att tcg ttt ccc gga gaa aaa gtg atg gaa gag gcc aag gca ttc aca        576
Ile Ser Phe Pro Gly Glu Lys Val Met Glu Glu Ala Lys Ala Phe Thr
              180                 185                 190

aga gaa tat cta aac caa gtt tta gct gga cac ggg gat gtg act gac        624
Arg Glu Tyr Leu Asn Gln Val Leu Ala Gly His Gly Asp Val Thr Asp
          195                 200                 205

gtg gat caa agc ctt ttg aga gag gtg aag tac gca ttg gag ttt cca        672
Val Asp Gln Ser Leu Leu Arg Glu Val Lys Tyr Ala Leu Glu Phe Pro
      210                 215                 220

tgg cat tgc agt gtg ccg aga tgg gag gca agg agc ttt ctc gaa ata        720
Trp His Cys Ser Val Pro Arg Trp Glu Ala Arg Ser Phe Leu Glu Ile
225                 230                 235                 240
```

```
tat gga cac aac cat tcg tgg ctc aag tcg aat atc aac caa aaa atg          768
Tyr Gly His Asn His Ser Trp Leu Lys Ser Asn Ile Asn Gln Lys Met
                245                 250                 255

ttg aag tta gcc aaa ttg gac ttc aat att ctg caa tgc aaa cat cac          816
Leu Lys Leu Ala Lys Leu Asp Phe Asn Ile Leu Gln Cys Lys His His
                260                 265                 270

aag gag ata cag ttt att aca agg tgg tgg aga gac tcg ggt ata tcg          864
Lys Glu Ile Gln Phe Ile Thr Arg Trp Trp Arg Asp Ser Gly Ile Ser
                275                 280                 285

cag ctg aat ttc tat cga aag cga cac gtg gaa tat tat tct tgg gtt          912
Gln Leu Asn Phe Tyr Arg Lys Arg His Val Glu Tyr Tyr Ser Trp Val
    290                 295                 300

gtt atg tgc att ttt gag cca gag ttc tct gaa agt aga att gcc ttc          960
Val Met Cys Ile Phe Glu Pro Glu Phe Ser Glu Ser Arg Ile Ala Phe
305                 310                 315                 320

gcc aaa act gct atc ctg tgt act gtt cta gat gac ctc tat gat acg         1008
Ala Lys Thr Ala Ile Leu Cys Thr Val Leu Asp Asp Leu Tyr Asp Thr
                325                 330                 335

cac gca aca ttg cat gaa atc aaa atc atg aca gag gga gtg aga cga         1056
His Ala Thr Leu His Glu Ile Lys Ile Met Thr Glu Gly Val Arg Arg
                340                 345                 350

tgg gat ctt tcg ttg aca gat gac ctc cca gac tac att aaa att gca         1104
Trp Asp Leu Ser Leu Thr Asp Asp Leu Pro Asp Tyr Ile Lys Ile Ala
                355                 360                 365

ttc cag ttc ttc ttc aat aca gtg aat gaa ttg ata gtt gaa atc gtg         1152
Phe Gln Phe Phe Phe Asn Thr Val Asn Glu Leu Ile Val Glu Ile Val
    370                 375                 380

aaa cgg caa ggg cgg gat atg aca acc ata gtt aaa gat tgc tgg aag         1200
Lys Arg Gln Gly Arg Asp Met Thr Thr Ile Val Lys Asp Cys Trp Lys
385                 390                 395                 400

cga tac att gag tct tat ctg caa gaa gcg gaa tgg ata gca act gga         1248
Arg Tyr Ile Glu Ser Tyr Leu Gln Glu Ala Glu Trp Ile Ala Thr Gly
                405                 410                 415

cat att ccc act ttt aac gaa tac ata aag aac ggc atg gct agc tca         1296
His Ile Pro Thr Phe Asn Glu Tyr Ile Lys Asn Gly Met Ala Ser Ser
                420                 425                 430

ggg atg tgt att cta aat ttg aat cca ctt ctc ttg ttg gat aaa ctt         1344
Gly Met Cys Ile Leu Asn Leu Asn Pro Leu Leu Leu Leu Asp Lys Leu
                435                 440                 445

ctc ccc gac aac att ctg gag caa ata cat tct cca tcc aag atc ctg         1392
Leu Pro Asp Asn Ile Leu Glu Gln Ile His Ser Pro Ser Lys Ile Leu
    450                 455                 460

gac ctc tta gaa ttg acg ggc aga atc gcc gat gac tta aaa gat ttc         1440
```

```
Asp Leu Leu Glu Leu Thr Gly Arg Ile Ala Asp Asp Leu Lys Asp Phe
465                 470                 475                 480

gag gac gag aag gaa cgc ggg gag atg gct tca tct tta cag tgt tat        1488
Glu Asp Glu Lys Glu Arg Gly Glu Met Ala Ser Ser Leu Gln Cys Tyr
                    485                 490                 495

atg aaa gaa aat cct gaa tct aca gtg gaa aat gct tta aat cac ata        1536
Met Lys Glu Asn Pro Glu Ser Thr Val Glu Asn Ala Leu Asn His Ile
            500                 505                 510

aaa ggc atc ctt aat cgt tcc ctt gag gaa ttt aat tgg gag ttt atg        1584
Lys Gly Ile Leu Asn Arg Ser Leu Glu Glu Phe Asn Trp Glu Phe Met
            515                 520                 525

aag cag gat agt gtc cca atg tgt tgc aag aaa ttc act ttc aat ata        1632
Lys Gln Asp Ser Val Pro Met Cys Cys Lys Lys Phe Thr Phe Asn Ile
        530                 535                 540

ggt cga gga ctt caa ttc atc tac aaa tac aga gac ggc tta tac att        1680
Gly Arg Gly Leu Gln Phe Ile Tyr Lys Tyr Arg Asp Gly Leu Tyr Ile
545                 550                 555                 560

tct gac aag gaa gta aag gac cag ata ttc aaa att cta gtc cac caa        1728
Ser Asp Lys Glu Val Lys Asp Gln Ile Phe Lys Ile Leu Val His Gln
                565                 570                 575

gtt cca atg gag gaa tag tgatggtctt ggttgtagtt gtctattatg              1776
Val Pro Met Glu Glu
                580

gtatattgca ttgacattta tgcttaaagg tgtttcttaa acgtttaggg cggaccgtta      1836
aataagttgg caataattaa tatctcgag                                        1865
```

<210> 48
<211> 581
<212> PRT
<213> Abies grandis

<400> 48
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Met Ala Glu Ile Ser Glu Ser Ser Ile Pro Arg Arg Thr Gly Asn His
1               5                   10                  15
His Gly Asn Val Trp Asp Asp Asp Leu Ile His Ser Leu Asn Ser Pro
            20                  25                  30
Tyr Gly Ala Pro Ala Tyr Tyr Glu Leu Leu Gln Lys Leu Ile Gln Glu
        35                  40                  45
Ile Lys His Leu Leu Leu Thr Glu Met Glu Met Asp Asp Gly Asp His
    50                  55                  60
Asp Leu Ile Lys Arg Leu Gln Ile Val Asp Thr Leu Glu Cys Leu Gly
65                  70                  75                  80
Ile Asp Arg His Phe Glu His Glu Ile Gln Thr Ala Ala Leu Asp Tyr
                85                  90                  95
Val Tyr Arg Trp Trp Asn Glu Lys Gly Ile Gly Glu Gly Ser Arg Asp
            100                 105                 110
Ser Phe Ser Lys Asp Leu Asn Ala Thr Ala Leu Gly Phe Arg Ala Leu
            115                 120                 125
Arg Leu His Arg Tyr Asn Val Ser Ser Gly Val Leu Lys Asn Phe Lys
```

```
          130                    135                    140
Asp Glu Asn Gly Lys Phe Phe Cys Asn Phe Thr Gly Glu Glu Gly Arg
145                    150                    155                    160
Gly Asp Lys Gln Val Arg Ser Met Leu Ser Leu Leu Arg Ala Ser Glu
                   165                    170                    175
Ile Ser Phe Pro Gly Glu Lys Val Met Glu Glu Ala Lys Ala Phe Thr
               180                    185                    190
Arg Glu Tyr Leu Asn Gln Val Leu Ala Gly His Gly Asp Val Thr Asp
           195                    200                    205
Val Asp Gln Ser Leu Leu Arg Glu Val Lys Tyr Ala Leu Glu Phe Pro
       210                    215                    220
Trp His Cys Ser Val Pro Arg Trp Glu Ala Arg Ser Phe Leu Glu Ile
225                    230                    235                    240
Tyr Gly His Asn His Ser Trp Leu Lys Ser Asn Ile Asn Gln Lys Met
                   245                    250                    255
Leu Lys Leu Ala Lys Leu Asp Phe Asn Ile Leu Gln Cys Lys His His
               260                    265                    270
Lys Glu Ile Gln Phe Ile Thr Arg Trp Trp Arg Asp Ser Gly Ile Ser
           275                    280                    285
Gln Leu Asn Phe Tyr Arg Lys Arg His Val Glu Tyr Tyr Ser Trp Val
       290                    295                    300
Val Met Cys Ile Phe Glu Pro Glu Phe Ser Glu Ser Arg Ile Ala Phe
305                    310                    315                    320
Ala Lys Thr Ala Ile Leu Cys Thr Val Leu Asp Asp Leu Tyr Asp Thr
                   325                    330                    335
His Ala Thr Leu His Glu Ile Lys Ile Met Thr Glu Gly Val Arg Arg
               340                    345                    350
Trp Asp Leu Ser Leu Thr Asp Asp Leu Pro Asp Tyr Ile Lys Ile Ala
           355                    360                    365
Phe Gln Phe Phe Phe Asn Thr Val Asn Glu Leu Ile Val Glu Ile Val
       370                    375                    380
Lys Arg Gln Gly Arg Asp Met Thr Thr Ile Val Lys Asp Cys Trp Lys
385                    390                    395                    400
Arg Tyr Ile Glu Ser Tyr Leu Gln Glu Ala Glu Trp Ile Ala Thr Gly
                   405                    410                    415
His Ile Pro Thr Phe Asn Glu Tyr Ile Lys Asn Gly Met Ala Ser Ser
               420                    425                    430
Gly Met Cys Ile Leu Asn Leu Asn Pro Leu Leu Leu Leu Asp Lys Leu
               435                    440                    445
Leu Pro Asp Asn Ile Leu Glu Gln Ile His Ser Pro Ser Lys Ile Leu
       450                    455                    460
Asp Leu Leu Glu Leu Thr Gly Arg Ile Ala Asp Asp Leu Lys Asp Phe
465                    470                    475                    480
Glu Asp Glu Lys Glu Arg Gly Glu Met Ala Ser Ser Leu Gln Cys Tyr
                   485                    490                    495
Met Lys Glu Asn Pro Glu Ser Thr Val Glu Asn Ala Leu Asn His Ile
               500                    505                    510
Lys Gly Ile Leu Asn Arg Ser Leu Glu Glu Phe Asn Trp Glu Phe Met
               515                    520                    525
Lys Gln Asp Ser Val Pro Met Cys Cys Lys Lys Phe Thr Phe Asn Ile
               530                    535                    540
Gly Arg Gly Leu Gln Phe Ile Tyr Lys Tyr Arg Asp Gly Leu Tyr Ile
545                    550                    555                    560
Ser Asp Lys Glu Val Lys Asp Gln Ile Phe Lys Ile Leu Val His Gln
                   565                    570                    575
Val Pro Met Glu Glu
               580
```

<210> 49
<211> 1785
<212> DNA
<213> Abies grandis

<220>
<221> CDS
<222> (4)...(1782)
<223> gamma-humulene synthase

<400> 49
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 tcc atg gct cag att tct gaa tct gta tca ccc tct acc gat ttg aag        48
     Met Ala Gln Ile Ser Glu Ser Val Ser Pro Ser Thr Asp Leu Lys
     1               5                   10                  15

 agc acc gaa tct tcc att acc tct aat cga cat gga aat atg tgg gag        96
 Ser Thr Glu Ser Ser Ile Thr Ser Asn Arg His Gly Asn Met Trp Glu
                 20                  25                  30

 gac gat cgc ata cag tct ctc aac tca cct tat ggg gca cct gca tat       144
 Asp Asp Arg Ile Gln Ser Leu Asn Ser Pro Tyr Gly Ala Pro Ala Tyr
             35                  40                  45

 caa gaa cgc agc gaa aag ctt att gaa gag atc aaa ctt tta ttt ttg       192
 Gln Glu Arg Ser Glu Lys Leu Ile Glu Glu Ile Lys Leu Leu Phe Leu
         50                  55                  60

 agt gac atg gac gat agc tgc aat gat agc gat cgt gat tta atc aaa       240
 Ser Asp Met Asp Asp Ser Cys Asn Asp Ser Asp Arg Asp Leu Ile Lys
     65                  70                  75

 cgt ctt gag atc gtt gat act gtc gag tgt ctg gga att gat cga cat       288
 Arg Leu Glu Ile Val Asp Thr Val Glu Cys Leu Gly Ile Asp Arg His
 80                  85                  90                  95

 ttt caa cct gag ata aaa tta gct ctg gat tac gtt tac aga tgt tgg       336
 Phe Gln Pro Glu Ile Lys Leu Ala Leu Asp Tyr Val Tyr Arg Cys Trp
                 100                 105                 110

 aac gaa aga ggc atc gga gag gga tca aga gat tcc ctc aag aaa gat       384
 Asn Glu Arg Gly Ile Gly Glu Gly Ser Arg Asp Ser Leu Lys Lys Asp
             115                 120                 125

 ctg aac gct aca gct ttg gga ttc cgg gct ctc cga ctc cat cga tat       432
 Leu Asn Ala Thr Ala Leu Gly Phe Arg Ala Leu Arg Leu His Arg Tyr
         130                 135                 140

 aac gta tcc tca ggt gtc ttg gag aat ttc aga gat gat aac ggg cag       480
 Asn Val Ser Ser Gly Val Leu Glu Asn Phe Arg Asp Asp Asn Gly Gln
     145                 150                 155

 ttc ttc tgc ggt tct aca gtt gaa gaa gaa gga gca gaa gca tat aat       528
 Phe Phe Cys Gly Ser Thr Val Glu Glu Glu Gly Ala Glu Ala Tyr Asn
 160                 165                 170                 175

 aaa cac gta aga tgc atg ctg tca tta tcg cga gct tca aac att tta       576
```

```
            Lys His Val Arg Cys Met Leu Ser Leu Ser Arg Ala Ser Asn Ile Leu
                        180                 185                 190

ttt ccg ggc gaa aaa gtg atg gaa gag gcg aag gca ttc aca aca aat          624
Phe Pro Gly Glu Lys Val Met Glu Glu Ala Lys Ala Phe Thr Thr Asn
            195                 200                 205

tat cta aag aaa gtt tta gca gga cgg gag gct acc cac gtc gat gaa          672
Tyr Leu Lys Lys Val Leu Ala Gly Arg Glu Ala Thr His Val Asp Glu
            210                 215                 220

agc ctt ttg gga gag gtg aag tac gca ttg gag ttt cca tgg cat tgc          720
Ser Leu Leu Gly Glu Val Lys Tyr Ala Leu Glu Phe Pro Trp His Cys
225                 230                 235

agt gtg cag aga tgg gag gca agg agc ttt atc gaa ata ttt gga caa          768
Ser Val Gln Arg Trp Glu Ala Arg Ser Phe Ile Glu Ile Phe Gly Gln
240                 245                 250                 255

att gat tca gag ctt aag tcg aat ttg agc aaa aaa atg tta gag ttg          816
Ile Asp Ser Glu Leu Lys Ser Asn Leu Ser Lys Lys Met Leu Glu Leu
                260                 265                 270

gcg aaa ttg gac ttc aat att ctg caa tgc aca cat cag aaa gaa ctg          864
Ala Lys Leu Asp Phe Asn Ile Leu Gln Cys Thr His Gln Lys Glu Leu
            275                 280                 285

cag att atc tca agg tgg ttc gca gac tca agt ata gca tcc ctg aat          912
Gln Ile Ile Ser Arg Trp Phe Ala Asp Ser Ser Ile Ala Ser Leu Asn
            290                 295                 300

ttc tat cgg aaa tgt tac gtc gaa ttt tac ttt tgg atg gct gca gcc          960
Phe Tyr Arg Lys Cys Tyr Val Glu Phe Tyr Phe Trp Met Ala Ala Ala
            305                 310                 315

atc tcc gag ccg gag ttt tct gga agc aga gtt gcc ttc aca aaa att         1008
Ile Ser Glu Pro Glu Phe Ser Gly Ser Arg Val Ala Phe Thr Lys Ile
320                 325                 330                 335

gct ata ctg atg aca atg cta gat gac ctg tac gat act cac gga acc         1056
Ala Ile Leu Met Thr Met Leu Asp Asp Leu Tyr Asp Thr His Gly Thr
                340                 345                 350

ttg gac caa ctc aaa atc ttt aca gag gga gtg aga cga tgg gat gtt         1104
Leu Asp Gln Leu Lys Ile Phe Thr Glu Gly Val Arg Arg Trp Asp Val
            355                 360                 365

tcg ttg gta gag ggc ctc cca gac ttc atg aaa att gca ttc gag ttc         1152
Ser Leu Val Glu Gly Leu Pro Asp Phe Met Lys Ile Ala Phe Glu Phe
            370                 375                 380

tgg tta aag aca tct aat gaa ttg att gct gaa gct gtt aaa gcg caa         1200
Trp Leu Lys Thr Ser Asn Glu Leu Ile Ala Glu Ala Val Lys Ala Gln
385                 390                 395

ggg caa gat atg gcg gcc tac ata aga aaa aat gca tgg gag cga tac         1248
Gly Gln Asp Met Ala Ala Tyr Ile Arg Lys Asn Ala Trp Glu Arg Tyr
```

```
      400                  405                 410                 415
ctt gaa gct tat ctg caa gat gcg gaa tgg ata gcc act gga cat gtc      1296
Leu Glu Ala Tyr Leu Gln Asp Ala Glu Trp Ile Ala Thr Gly His Val
                420                 425                 430

ccc acc ttt gat gag tac ttg aat aat ggc aca cca aac act ggg atg      1344
Pro Thr Phe Asp Glu Tyr Leu Asn Asn Gly Thr Pro Asn Thr Gly Met
                435                 440                 445

tgt gta ttg aat ttg att ccg ctt ctg tta atg ggt gaa cat tta cca      1392
Cys Val Leu Asn Leu Ile Pro Leu Leu Leu Met Gly Glu His Leu Pro
                450                 455                 460

atc gac att ctg gag caa ata ttc ttg ccc tcc agg ttc cac cat ctc      1440
Ile Asp Ile Leu Glu Gln Ile Phe Leu Pro Ser Arg Phe His His Leu
                465                 470                 475

att gaa ttg gct tcc agg ctc gtc gat gac gcg aga gat ttc cag gcg      1488
Ile Glu Leu Ala Ser Arg Leu Val Asp Asp Ala Arg Asp Phe Gln Ala
480                 485                 490                 495

gag aag gat cat ggg gat tta tcg tgt att gag tgt tat tta aaa gat      1536
Glu Lys Asp His Gly Asp Leu Ser Cys Ile Glu Cys Tyr Leu Lys Asp
                500                 505                 510

cat cct gag tct aca gta gaa gat gct tta aat cat gtt aat ggc ctc      1584
His Pro Glu Ser Thr Val Glu Asp Ala Leu Asn His Val Asn Gly Leu
                515                 520                 525

ctt ggc aat tgc ctt ctg gaa atg aat tgg aag ttc tta aag aag cag      1632
Leu Gly Asn Cys Leu Leu Glu Met Asn Trp Lys Phe Leu Lys Lys Gln
                530                 535                 540

gac agt gtg cca ctc tcg tgt aag aag tac agc ttc cat gta ttg gca      1680
Asp Ser Val Pro Leu Ser Cys Lys Lys Tyr Ser Phe His Val Leu Ala
                545                 550                 555

cga agc atc caa ttc atg tac aat caa ggc gat ggc ttc tcc att tcg      1728
Arg Ser Ile Gln Phe Met Tyr Asn Gln Gly Asp Gly Phe Ser Ile Ser
560                 565                 570                 575

aac aaa gtg atc aag gat caa gtg cag aaa gtt ctt att gtc ccc gtg      1776
Asn Lys Val Ile Lys Asp Gln Val Gln Lys Val Leu Ile Val Pro Val
                580                 585                 590

cct att tga                                                           1785
Pro Ile

<210> 50
<211> 593
<212> PRT
<213> Abies grandis

<400> 50
 Met Ala Gln Ile Ser Glu Ser Val Ser Pro Ser Thr Asp Leu Lys Ser
  1               5                  10                  15
```

```
Thr Glu Ser Ser Ile Thr Ser Asn Arg His Gly Asn Met Trp Glu Asp
            20              25              30
Asp Arg Ile Gln Ser Leu Asn Ser Pro Tyr Gly Ala Pro Ala Tyr Gln
        35              40              45
Glu Arg Ser Glu Lys Leu Ile Glu Glu Ile Lys Leu Leu Phe Leu Ser
    50              55              60
Asp Met Asp Asp Ser Cys Asn Asp Ser Asp Arg Asp Leu Ile Lys Arg
65              70              75              80
Leu Glu Ile Val Asp Thr Val Glu Cys Leu Gly Ile Asp Arg His Phe
            85              90              95
Gln Pro Glu Ile Lys Leu Ala Leu Asp Tyr Val Tyr Arg Cys Trp Asn
            100             105             110
Glu Arg Gly Ile Gly Glu Gly Ser Arg Asp Ser Leu Lys Lys Asp Leu
        115             120             125
Asn Ala Thr Ala Leu Gly Phe Arg Ala Leu Arg Leu His Arg Tyr Asn
    130             135             140
Val Ser Ser Gly Val Leu Glu Asn Phe Arg Asp Asp Asn Gly Gln Phe
145             150             155             160
Phe Cys Gly Ser Thr Val Glu Glu Glu Gly Ala Glu Ala Tyr Asn Lys
            165             170             175
His Val Arg Cys Met Leu Ser Leu Ser Arg Ala Ser Asn Ile Leu Phe
            180             185             190
Pro Gly Glu Lys Val Met Glu Glu Ala Lys Ala Phe Thr Thr Asn Tyr
            195             200             205
Leu Lys Lys Val Leu Ala Gly Arg Glu Ala Thr His Val Asp Glu Ser
    210             215             220
Leu Leu Gly Glu Val Lys Tyr Ala Leu Glu Phe Pro Trp His Cys Ser
225             230             235             240
Val Gln Arg Trp Glu Ala Arg Ser Phe Ile Glu Ile Phe Gly Gln Ile
            245             250             255
Asp Ser Glu Leu Lys Ser Asn Leu Ser Lys Lys Met Leu Glu Leu Ala
            260             265             270
Lys Leu Asp Phe Asn Ile Leu Gln Cys Thr His Gln Lys Glu Leu Gln
            275             280             285
Ile Ile Ser Arg Trp Phe Ala Asp Ser Ser Ile Ala Ser Leu Asn Phe
    290             295             300
Tyr Arg Lys Cys Tyr Val Glu Phe Tyr Phe Trp Met Ala Ala Ala Ile
305             310             315             320
Ser Glu Pro Glu Phe Ser Gly Ser Arg Val Ala Phe Thr Lys Ile Ala
            325             330             335
Ile Leu Met Thr Met Leu Asp Asp Leu Tyr Asp Thr His Gly Thr Leu
            340             345             350
Asp Gln Leu Lys Ile Phe Thr Glu Gly Val Arg Arg Trp Asp Val Ser
        355             360             365
Leu Val Glu Gly Leu Pro Asp Phe Met Lys Ile Ala Phe Glu Phe Trp
    370             375             380
Leu Lys Thr Ser Asn Glu Leu Ile Ala Glu Ala Val Lys Ala Gln Gly
385             390             395             400
Gln Asp Met Ala Ala Tyr Ile Arg Lys Asn Ala Trp Glu Arg Tyr Leu
            405             410             415
Glu Ala Tyr Leu Gln Asp Ala Glu Trp Ile Ala Thr Gly His Val Pro
        420             425             430
Thr Phe Asp Glu Tyr Leu Asn Asn Gly Thr Pro Asn Thr Gly Met Cys
        435             440             445
Val Leu Asn Leu Ile Pro Leu Leu Leu Met Gly Glu His Leu Pro Ile
    450             455             460
Asp Ile Leu Glu Gln Ile Phe Leu Pro Ser Arg Phe His His Leu Ile
```

```
        465                     470                     475                     480
Glu Leu Ala Ser Arg Leu Val Asp Asp Ala Arg Asp Phe Gln Ala Glu
                    485                 490                 495
Lys Asp His Gly Asp Leu Ser Cys Ile Glu Cys Tyr Leu Lys Asp His
                500                 505                 510
Pro Glu Ser Thr Val Glu Asp Ala Leu Asn His Val Asn Gly Leu Leu
            515                 520                 525
Gly Asn Cys Leu Leu Glu Met Asn Trp Lys Phe Leu Lys Lys Gln Asp
        530                 535                 540
Ser Val Pro Leu Ser Cys Lys Lys Tyr Ser Phe His Val Leu Ala Arg
545                 550                 555                 560
Ser Ile Gln Phe Met Tyr Asn Gln Gly Asp Gly Phe Ser Ile Ser Asn
                565                 570                 575
Lys Val Ile Lys Asp Gln Val Gln Lys Val Leu Ile Val Pro Val Pro
            580                 585                 590
Ile
```

<210> 51
<211> 2024
<212> DNA
<213> Lycopersicon esculentum

<220>
<221> CDS
<222> (32)...(1675)
<223> VFNT germacrene C synthase

<400> 51

```
aaaaaaagcc aaaccttaga acaaacaagc a atg gct gct tct tct gct gat        52
                                    Met Ala Ala Ser Ser Ala Asp
                                    1               5

aag tgt cgc ccc ttg gct aat ttt cac cca tct gtt tgg gga tat cat      100
Lys Cys Arg Pro Leu Ala Asn Phe His Pro Ser Val Trp Gly Tyr His
        10                  15                  20

ttc ctt tct tat act cat gaa att act aat caa gaa aaa gtt gaa gtt      148
Phe Leu Ser Tyr Thr His Glu Ile Thr Asn Gln Glu Lys Val Glu Val
    25                  30                  35

gat gag tac aaa gag aca att aga aaa atg ctg gtg gaa act tgc gac      196
Asp Glu Tyr Lys Glu Thr Ile Arg Lys Met Leu Val Glu Thr Cys Asp
40                  45                  50                  55

aat agc act caa aag ctt gtg ttg ata gac gcg atg caa cga ttg gga      244
Asn Ser Thr Gln Lys Leu Val Leu Ile Asp Ala Met Gln Arg Leu Gly
                60                  65                  70

gtg gct tat cat ttc gat aat gaa att gaa aca tcc att caa aac att      292
Val Ala Tyr His Phe Asp Asn Glu Ile Glu Thr Ser Ile Gln Asn Ile
            75                  80                  85

ttt gat gca tcg tcc aaa cag aat gat aat gac aac aac ctt tac gtt      340
Phe Asp Ala Ser Ser Lys Gln Asn Asp Asn Asp Asn Asn Leu Tyr Val
        90                  95                  100
```

```
gtg tct ctt cgt ttt cga ctt gtg agg caa caa ggc cat tac atg tct      388
Val Ser Leu Arg Phe Arg Leu Val Arg Gln Gln Gly His Tyr Met Ser
    105                 110                 115

tca gat gtg ttc aag caa ttc acc aac caa gat ggg aaa ttc aag gaa      436
Ser Asp Val Phe Lys Gln Phe Thr Asn Gln Asp Gly Lys Phe Lys Glu
120                 125                 130                 135

aca ctt act aat gat gtc caa gga tta ttg agt ttg tat gaa gca tca      484
Thr Leu Thr Asn Asp Val Gln Gly Leu Leu Ser Leu Tyr Glu Ala Ser
                140                 145                 150

cat ctg aga gtg cgt aat gag gag att ctt gaa gaa gct ctt aca ttt      532
His Leu Arg Val Arg Asn Glu Glu Ile Leu Glu Glu Ala Leu Thr Phe
                155                 160                 165

acc acc act cat ctc gag tct att gtc tcc aac ttg agc aat aat aat      580
Thr Thr Thr His Leu Glu Ser Ile Val Ser Asn Leu Ser Asn Asn Asn
            170                 175                 180

aac tct ctt aag gtt gaa gtt ggt gaa gcc tta act cag cct att cgc      628
Asn Ser Leu Lys Val Glu Val Gly Glu Ala Leu Thr Gln Pro Ile Arg
        185                 190                 195

atg act tta cca agg atg gga gct aga aaa tac ata tcc att tac gaa      676
Met Thr Leu Pro Arg Met Gly Ala Arg Lys Tyr Ile Ser Ile Tyr Glu
200                 205                 210                 215

aac aat gat gca cac cac cat ttg ctt ttg aaa ttt gct aaa ttg gat      724
Asn Asn Asp Ala His His His Leu Leu Leu Lys Phe Ala Lys Leu Asp
                220                 225                 230

ttt aac atg ctg caa aag ttt cac caa aga gag ctt agt gat ctt aca      772
Phe Asn Met Leu Gln Lys Phe His Gln Arg Glu Leu Ser Asp Leu Thr
                235                 240                 245

agg tgg tgg aaa gat ttg gat ttt gca aat aaa tat cca tat gca aga      820
Arg Trp Trp Lys Asp Leu Asp Phe Ala Asn Lys Tyr Pro Tyr Ala Arg
        250                 255                 260

gac agg ttg gtt gag tgt tac ttc tgg ata tta gga gtg tat ttt gag      868
Asp Arg Leu Val Glu Cys Tyr Phe Trp Ile Leu Gly Val Tyr Phe Glu
        265                 270                 275

cca aaa tat agt cgt gcg aga aaa atg atg aca aaa gta ctc aac ctg      916
Pro Lys Tyr Ser Arg Ala Arg Lys Met Met Thr Lys Val Leu Asn Leu
280                 285                 290                 295

acc tcc att att gac gac act ttt gat gct tat gca acc ttt gac gaa      964
Thr Ser Ile Ile Asp Asp Thr Phe Asp Ala Tyr Ala Thr Phe Asp Glu
                300                 305                 310

ctt gtg act ttc aat gat gca atc cag aga tgg gat gct aat gca att     1012
Leu Val Thr Phe Asn Asp Ala Ile Gln Arg Trp Asp Ala Asn Ala Ile
                315                 320                 325

gat tca ata caa cca tat atg aga cct gct tat caa gct ctt cta gac     1060
```

```
Asp Ser Ile Gln Pro Tyr Met Arg Pro Ala Tyr Gln Ala Leu Leu Asp
    330             335         340
```

```
att tac agt gaa atg gaa caa gtg ttg tcc aaa gaa ggt aaa ctg gac    1108
Ile Tyr Ser Glu Met Glu Gln Val Leu Ser Lys Glu Gly Lys Leu Asp
    345             350             355
```

```
cgt gta tac tat gca aaa aat gag atg aaa aag ttg gtg aga gcc tat    1156
Arg Val Tyr Tyr Ala Lys Asn Glu Met Lys Lys Leu Val Arg Ala Tyr
360             365             370             375
```

```
ttt aag gaa acc caa tgg ttg aat gat tgt gac cat att cca aaa tat    1204
Phe Lys Glu Thr Gln Trp Leu Asn Asp Cys Asp His Ile Pro Lys Tyr
            380             385             390
```

```
gag gaa caa gtg gag aat gca atc gta agt gct ggc tat atg atg ata    1252
Glu Glu Gln Val Glu Asn Ala Ile Val Ser Ala Gly Tyr Met Met Ile
            395             400             405
```

```
tca aca act tgc ttg gtc ggt ata gaa gaa ttt ata tcc cac gag act    1300
Ser Thr Thr Cys Leu Val Gly Ile Glu Glu Phe Ile Ser His Glu Thr
            410             415             420
```

```
ttt gaa tgg ttg atg aat gag tct gtg att gtt cga gct tcc gca ttg    1348
Phe Glu Trp Leu Met Asn Glu Ser Val Ile Val Arg Ala Ser Ala Leu
    425             430             435
```

```
att gcc aga gca atg aac gat att gtt gga cat gaa gat gaa caa gaa    1396
Ile Ala Arg Ala Met Asn Asp Ile Val Gly His Glu Asp Glu Gln Glu
440             445             450             455
```

```
aga gga cat gta gct tca ctt att gaa tgt tac atg aaa gat tat gga    1444
Arg Gly His Val Ala Ser Leu Ile Glu Cys Tyr Met Lys Asp Tyr Gly
            460             465             470
```

```
gct tca aag caa gag act tac att aag ttc ctg aaa gag gtc acc aat    1492
Ala Ser Lys Gln Glu Thr Tyr Ile Lys Phe Leu Lys Glu Val Thr Asn
            475             480             485
```

```
gca tgg aag gac ata aac aaa caa ttc tcc cgt cca act gaa gta cca    1540
Ala Trp Lys Asp Ile Asn Lys Gln Phe Ser Arg Pro Thr Glu Val Pro
    490             495             500
```

```
atg ttt gtc ctt gaa cga gtt cta aat ttg aca cgt gtg gct gac acg    1588
Met Phe Val Leu Glu Arg Val Leu Asn Leu Thr Arg Val Ala Asp Thr
    505             510             515
```

```
tta tat aag gag aaa gat aca tat tca acc gcc aaa gga aaa ctt aaa    1636
Leu Tyr Lys Glu Lys Asp Thr Tyr Ser Thr Ala Lys Gly Lys Leu Lys
520             525             530             535
```

```
aac atg att aat cca ata cta att gaa tct gtc aaa ata taa           1678
Asn Met Ile Asn Pro Ile Leu Ile Glu Ser Val Lys Ile
            540             545
```

```
atataatgct gaaattgcac cttcatcatc caactattca cagcaaaata aggcatataa    1738
taaattgaag actcacaaca tatgagttgt taattcctgg gatgtttgaa ataaacaata    1798
```

```
attgttttta tttaatttgc taagccaaag tgaaatatac aacacttgag ttgtattaaa      1858
tcatgtttta tctcatttcc agcttgtgag tttggattat tatattgtta attatcatca      1918
ctttataatg tactgtaatc gtattgtatt tgtattgtag tgttgtcata ataaaatttg      1978
aataaaatat atttttgttt caattccaaa aaaaaaaaaa aaaaa                      2024
```

<210> 52
<211> 548
<212> PRT
<213> Lycopersicon esculentum

<400> 52

```
Met Ala Ala Ser Ser Ala Asp Lys Cys Arg Pro Leu Ala Asn Phe His
  1               5                  10                  15
Pro Ser Val Trp Gly Tyr His Phe Leu Ser Tyr Thr His Glu Ile Thr
             20                  25                  30
Asn Gln Glu Lys Val Glu Val Asp Glu Tyr Lys Glu Thr Ile Arg Lys
         35                  40                  45
Met Leu Val Glu Thr Cys Asp Asn Ser Thr Gln Lys Leu Val Leu Ile
     50                  55                  60
Asp Ala Met Gln Arg Leu Gly Val Ala Tyr His Phe Asp Asn Glu Ile
 65                  70                  75                  80
Glu Thr Ser Ile Gln Asn Ile Phe Asp Ala Ser Ser Lys Gln Asn Asp
                 85                  90                  95
Asn Asp Asn Asn Leu Tyr Val Val Ser Leu Arg Phe Arg Leu Val Arg
                100                 105                 110
Gln Gln Gly His Tyr Met Ser Ser Asp Val Phe Lys Gln Phe Thr Asn
            115                 120                 125
Gln Asp Gly Lys Phe Lys Glu Thr Leu Thr Asn Asp Val Gln Gly Leu
        130                 135                 140
Leu Ser Leu Tyr Glu Ala Ser His Leu Arg Val Arg Asn Glu Glu Ile
145                 150                 155                 160
Leu Glu Glu Ala Leu Thr Phe Thr Thr Thr His Leu Glu Ser Ile Val
                165                 170                 175
Ser Asn Leu Ser Asn Asn Asn Ser Leu Lys Val Glu Val Gly Glu
            180                 185                 190
Ala Leu Thr Gln Pro Ile Arg Met Thr Leu Pro Arg Met Gly Ala Arg
            195                 200                 205
Lys Tyr Ile Ser Ile Tyr Glu Asn Asn Asp Ala His His His Leu Leu
        210                 215                 220
Leu Lys Phe Ala Lys Leu Asp Phe Asn Met Leu Gln Lys Phe His Gln
225                 230                 235                 240
Arg Glu Leu Ser Asp Leu Thr Arg Trp Trp Lys Asp Leu Asp Phe Ala
                245                 250                 255
Asn Lys Tyr Pro Tyr Ala Arg Asp Arg Leu Val Glu Cys Tyr Phe Trp
            260                 265                 270
Ile Leu Gly Val Tyr Phe Glu Pro Lys Tyr Ser Arg Ala Arg Lys Met
        275                 280                 285
Met Thr Lys Val Leu Asn Leu Thr Ser Ile Ile Asp Asp Thr Phe Asp
    290                 295                 300
Ala Tyr Ala Thr Phe Asp Glu Leu Val Thr Phe Asn Asp Ala Ile Gln
305                 310                 315                 320
Arg Trp Asp Ala Asn Ala Ile Asp Ser Ile Gln Pro Tyr Met Arg Pro
                325                 330                 335
Ala Tyr Gln Ala Leu Leu Asp Ile Tyr Ser Glu Met Glu Gln Val Leu
            340                 345                 350
Ser Lys Glu Gly Lys Leu Asp Arg Val Tyr Tyr Ala Lys Asn Glu Met
        355                 360                 365
```

```
Lys Lys Leu Val Arg Ala Tyr Phe Lys Glu Thr Gln Trp Leu Asn Asp
    370                 375             380
Cys Asp His Ile Pro Lys Tyr Glu Glu Gln Val Glu Asn Ala Ile Val
385                 390             395                 400
Ser Ala Gly Tyr Met Met Ile Ser Thr Thr Cys Leu Val Gly Ile Glu
            405             410                 415
Glu Phe Ile Ser His Glu Thr Phe Glu Trp Leu Met Asn Glu Ser Val
        420             425                 430
Ile Val Arg Ala Ser Ala Leu Ile Ala Arg Ala Met Asn Asp Ile Val
    435             440                 445
Gly His Glu Asp Glu Gln Glu Arg Gly His Val Ala Ser Leu Ile Glu
    450             455                 460
Cys Tyr Met Lys Asp Tyr Gly Ala Ser Lys Gln Glu Thr Tyr Ile Lys
465             470                 475                 480
Phe Leu Lys Glu Val Thr Asn Ala Trp Lys Asp Ile Asn Lys Gln Phe
            485                 490                 495
Ser Arg Pro Thr Glu Val Pro Met Phe Val Leu Glu Arg Val Leu Asn
            500             505                 510
Leu Thr Arg Val Ala Asp Thr Leu Tyr Lys Glu Lys Asp Thr Tyr Ser
            515             520                 525
Thr Ala Lys Gly Lys Leu Lys Asn Met Ile Asn Pro Ile Leu Ile Glu
    530             535                 540
Ser Val Lys Ile
545
```

```
<210> 53
<211> 1912
<212> DNA
<213> Salvia officinalis

<220>
<221> CDS
<222> (26)...(1795)
<223> (+)-sabinene syntase

<400> 53
agcaatatta caactaacaa taaaa atg tct tcc att agc ata aac ata gct          52
                             Met Ser Ser Ile Ser Ile Asn Ile Ala
                              1               5

atg cca ctg aat tcc ctc cac aac ttt gag agg aaa cct tca aaa gca         100
Met Pro Leu Asn Ser Leu His Asn Phe Glu Arg Lys Pro Ser Lys Ala
 10                  15                  20                  25

tgg tct acc tct tgc act gca ccc gca gct cgc ctc cgg gca tct tcc         148
Trp Ser Thr Ser Cys Thr Ala Pro Ala Ala Arg Leu Arg Ala Ser Ser
                30                  35                  40

tcc tta caa caa gaa aaa cct cac caa atc cga cgc tct ggg gat tac         196
Ser Leu Gln Gln Glu Lys Pro His Gln Ile Arg Arg Ser Gly Asp Tyr
                45                  50                  55

caa ccc tct ctt tgg gat ttc aat tac ata cag tct ctc aac act ccg         244
Gln Pro Ser Leu Trp Asp Phe Asn Tyr Ile Gln Ser Leu Asn Thr Pro
            60                  65                  70

tat aag gag cag aga cac ttt aat agg caa gca gag ttg att atg caa         292
```

```
Tyr Lys Glu Gln Arg His Phe Asn Arg Gln Ala Glu Leu Ile Met Gln
    75                  80                  85
```

```
gtg agg atg ttg ctc aag gta aag atg gag gca att caa cag ttg gag        340
Val Arg Met Leu Leu Lys Val Lys Met Glu Ala Ile Gln Gln Leu Glu
 90                  95                  100                 105
```

```
ttg att gat gac ttg caa tac ctg gga ctg tct tat ttc ttt caa gat        388
Leu Ile Asp Asp Leu Gln Tyr Leu Gly Leu Ser Tyr Phe Phe Gln Asp
                110                 115                 120
```

```
gag att aaa caa atc tta agt tct ata cac aat gag ccc aga tat ttc        436
Glu Ile Lys Gln Ile Leu Ser Ser Ile His Asn Glu Pro Arg Tyr Phe
                125                 130                 135
```

```
cac aat aat gat ttg tat ttc aca gct ctt gga ttc aga atc ctc aga        484
His Asn Asn Asp Leu Tyr Phe Thr Ala Leu Gly Phe Arg Ile Leu Arg
            140                 145                 150
```

```
caa cat ggt ttt aat gtt tcc gaa gat gta ttt gat tgt ttc aaa att        532
Gln His Gly Phe Asn Val Ser Glu Asp Val Phe Asp Cys Phe Lys Ile
    155                 160                 165
```

```
gag aag tgc agt gat ttc aat gca aac ctt gct caa gat acg aag gga        580
Glu Lys Cys Ser Asp Phe Asn Ala Asn Leu Ala Gln Asp Thr Lys Gly
170                 175                 180                 185
```

```
atg tta caa ctt tat gaa gca tct ttc ctt ttg aga gaa ggt gaa gat        628
Met Leu Gln Leu Tyr Glu Ala Ser Phe Leu Leu Arg Glu Gly Glu Asp
                190                 195                 200
```

```
aca ttg gag cta gca aga cga ttt tcc acc aga tct cta cga gaa aaa        676
Thr Leu Glu Leu Ala Arg Arg Phe Ser Thr Arg Ser Leu Arg Glu Lys
                205                 210                 215
```

```
ttt gat gaa ggt ggt gat gaa att gat gaa gat cta tca tcg tgg att        724
Phe Asp Glu Gly Gly Asp Glu Ile Asp Glu Asp Leu Ser Ser Trp Ile
                220                 225                 230
```

```
cgc cat tcc ttg gat ctt cct ctt cat tgg agg gtc caa gga tta gag        772
Arg His Ser Leu Asp Leu Pro Leu His Trp Arg Val Gln Gly Leu Glu
    235                 240                 245
```

```
gca aga tgg ttc tta gat gct tat gcg agg agg ccg gac atg aat cca        820
Ala Arg Trp Phe Leu Asp Ala Tyr Ala Arg Arg Pro Asp Met Asn Pro
250                 255                 260                 265
```

```
ctt att ttc aaa ctc gcc aaa ctc aac ttc aat att gtt cag gca aca        868
Leu Ile Phe Lys Leu Ala Lys Leu Asn Phe Asn Ile Val Gln Ala Thr
                270                 275                 280
```

```
tat caa gaa gaa ctg aaa gat atc tca agg tgg tgg aat agt tcg tgc        916
Tyr Gln Glu Glu Leu Lys Asp Ile Ser Arg Trp Trp Asn Ser Ser Cys
                285                 290                 295
```

```
ctt gct gag aaa ctc cca ttt gtg aga gat agg att gtg gaa tgc ttc        964
Leu Ala Glu Lys Leu Pro Phe Val Arg Asp Arg Ile Val Glu Cys Phe
```

```
                 300                    305                    310
ttt tgg gcc atc gcg gct ttt gag cct cac caa tat agt tat cag aga    1012
Phe Trp Ala Ile Ala Ala Phe Glu Pro His Gln Tyr Ser Tyr Gln Arg
    315                    320                    325

aaa atg gcc gcc gtt att att act ttc ata aca att atc gat gat gtt    1060
Lys Met Ala Ala Val Ile Ile Thr Phe Ile Thr Ile Ile Asp Asp Val
330                    335                    340                    345

tat gat gtg tat gga aca ata gaa gaa cta gaa cta tta aca gat atg    1108
Tyr Asp Val Tyr Gly Thr Ile Glu Glu Leu Glu Leu Leu Thr Asp Met
                    350                    355                    360

att cgc aga tgg gat aat aaa tca ata agc caa ctt cca tat tat atg    1156
Ile Arg Arg Trp Asp Asn Lys Ser Ile Ser Gln Leu Pro Tyr Tyr Met
                    365                    370                    375

caa gtg tgc tat ttg gca cta tac aac ttc gtt tct gag cgg gct tac    1204
Gln Val Cys Tyr Leu Ala Leu Tyr Asn Phe Val Ser Glu Arg Ala Tyr
                    380                    385                    390

gat att cta aaa gat caa cat ttc aac agc atc cca tat tta cag aga    1252
Asp Ile Leu Lys Asp Gln His Phe Asn Ser Ile Pro Tyr Leu Gln Arg
                    395                    400                    405

tcg tgg gta agt ttg gtt gaa gga tat ctt aag gag gca tac tgg tac    1300
Ser Trp Val Ser Leu Val Glu Gly Tyr Leu Lys Glu Ala Tyr Trp Tyr
410                    415                    420                    425

tac aat ggc tat aaa cca agc ttg gaa gaa tat ctc aac aac gcc aag    1348
Tyr Asn Gly Tyr Lys Pro Ser Leu Glu Glu Tyr Leu Asn Asn Ala Lys
                    430                    435                    440

att tca ata tcg gct cct aca atc ata tcc cag ctt tat ttt aca tta    1396
Ile Ser Ile Ser Ala Pro Thr Ile Ile Ser Gln Leu Tyr Phe Thr Leu
                    445                    450                    455

gca aac tcg att gat gaa aca gct atc gag agc ttg tac caa tat cat    1444
Ala Asn Ser Ile Asp Glu Thr Ala Ile Glu Ser Leu Tyr Gln Tyr His
                    460                    465                    470

aac ata ctt tac cta tca gga acc ata tta agg ctt gct gac gat ctt    1492
Asn Ile Leu Tyr Leu Ser Gly Thr Ile Leu Arg Leu Ala Asp Asp Leu
                    475                    480                    485

ggg aca tca caa cat gag ctg gag aga gga gac gta ccg aaa gca atc    1540
Gly Thr Ser Gln His Glu Leu Glu Arg Gly Asp Val Pro Lys Ala Ile
490                    495                    500                    505

cag tgc tac atg aat gac aca aat gct tcg gag aga gag gcg gtg gaa    1588
Gln Cys Tyr Met Asn Asp Thr Asn Ala Ser Glu Arg Glu Ala Val Glu
                    510                    515                    520

cac gtg aag ttt ctg ata agg gag gcg tgg aag gag atg aac acg gtc    1636
His Val Lys Phe Leu Ile Arg Glu Ala Trp Lys Glu Met Asn Thr Val
                    525                    530                    535
```

```
aca aca gcc agc gat tgt ccg ttt acg gat gat ttg gtt gcg gcc gca        1684
Thr Thr Ala Ser Asp Cys Pro Phe Thr Asp Asp Leu Val Ala Ala Ala
        540                 545                 550

gct aat ctt gca agg gcg gct cag ttt ata tat ctc gac ggg gat ggg        1732
Ala Asn Leu Ala Arg Ala Ala Gln Phe Ile Tyr Leu Asp Gly Asp Gly
        555                 560                 565

cat ggc gtg caa cac tca gaa ata cat caa cag atg gga ggc ctg cta        1780
His Gly Val Gln His Ser Glu Ile His Gln Gln Met Gly Gly Leu Leu
570                 575                 580                 585

ttc cag cct tat gtc tga ataaatcgaa aatccaacct actatgtatc              1828
Phe Gln Pro Tyr Val
                590

cctcgataat atattcttgg ggttaacatg tttaattaaa gttctaattd aaagagctga      1888
atcgatcctc aaaaaaaaaa aaaa                                              1912
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<210> 54
<211> 590
<212> PRT
<213> Salvia officinalis

<400> 54

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Met Ser Ser Ile Ser Ile Asn Ile Ala Met Pro Leu Asn Ser Leu His
1               5               10              15
Asn Phe Glu Arg Lys Pro Ser Lys Ala Trp Ser Thr Ser Cys Thr Ala
            20              25              30
Pro Ala Ala Arg Leu Arg Ala Ser Ser Ser Leu Gln Gln Glu Lys Pro
        35              40              45
His Gln Ile Arg Arg Ser Gly Asp Tyr Gln Pro Ser Leu Trp Asp Phe
        50              55              60
Asn Tyr Ile Gln Ser Leu Asn Thr Pro Tyr Lys Glu Gln Arg His Phe
65              70              75              80
Asn Arg Gln Ala Glu Leu Ile Met Gln Val Arg Met Leu Leu Lys Val
            85              90              95
Lys Met Glu Ala Ile Gln Gln Leu Glu Leu Ile Asp Asp Leu Gln Tyr
            100             105             110
Leu Gly Leu Ser Tyr Phe Phe Gln Asp Glu Ile Lys Gln Ile Leu Ser
        115             120             125
Ser Ile His Asn Glu Pro Arg Tyr Phe His Asn Asn Asp Leu Tyr Phe
        130             135             140
Thr Ala Leu Gly Phe Arg Ile Leu Arg Gln His Gly Phe Asn Val Ser
145             150             155             160
Glu Asp Val Phe Asp Cys Phe Lys Ile Glu Lys Cys Ser Asp Phe Asn
            165             170             175
Ala Asn Leu Ala Gln Asp Thr Lys Gly Met Leu Gln Leu Tyr Glu Ala
        180             185             190
Ser Phe Leu Leu Arg Glu Gly Glu Asp Thr Leu Glu Leu Ala Arg Arg
        195             200             205
Phe Ser Thr Arg Ser Leu Arg Glu Lys Phe Asp Glu Gly Gly Asp Glu
        210             215             220
Ile Asp Glu Asp Leu Ser Ser Trp Ile Arg His Ser Leu Asp Leu Pro
225             230             235             240
Leu His Trp Arg Val Gln Gly Leu Glu Ala Arg Trp Phe Leu Asp Ala
```

```
                  245                 250                 255
Tyr Ala Arg Arg Pro Asp Met Asn Pro Leu Ile Phe Lys Leu Ala Lys
            260                 265                 270
Leu Asn Phe Asn Ile Val Gln Ala Thr Tyr Gln Glu Glu Leu Lys Asp
            275                 280                 285
Ile Ser Arg Trp Trp Asn Ser Ser Cys Leu Ala Glu Lys Leu Pro Phe
            290                 295                 300
Val Arg Asp Arg Ile Val Glu Cys Phe Phe Trp Ala Ile Ala Ala Phe
305                 310                 315                 320
Glu Pro His Gln Tyr Ser Tyr Gln Arg Lys Met Ala Ala Val Ile Ile
                325                 330                 335
Thr Phe Ile Thr Ile Ile Asp Asp Val Tyr Asp Val Tyr Gly Thr Ile
                340                 345                 350
Glu Glu Leu Glu Leu Leu Thr Asp Met Ile Arg Arg Trp Asp Asn Lys
            355                 360                 365
Ser Ile Ser Gln Leu Pro Tyr Tyr Met Gln Val Cys Tyr Leu Ala Leu
            370                 375                 380
Tyr Asn Phe Val Ser Glu Arg Ala Tyr Asp Ile Leu Lys Asp Gln His
385                 390                 395                 400
Phe Asn Ser Ile Pro Tyr Leu Gln Arg Ser Trp Val Ser Leu Val Glu
                405                 410                 415
Gly Tyr Leu Lys Glu Ala Tyr Trp Tyr Tyr Asn Gly Tyr Lys Pro Ser
                420                 425                 430
Leu Glu Glu Tyr Leu Asn Asn Ala Lys Ile Ser Ile Ser Ala Pro Thr
            435                 440                 445
Ile Ile Ser Gln Leu Tyr Phe Thr Leu Ala Asn Ser Ile Asp Glu Thr
            450                 455                 460
Ala Ile Glu Ser Leu Tyr Gln Tyr His Asn Ile Leu Tyr Leu Ser Gly
465                 470                 475                 480
Thr Ile Leu Arg Leu Ala Asp Asp Leu Gly Thr Ser Gln His Glu Leu
                485                 490                 495
Glu Arg Gly Asp Val Pro Lys Ala Ile Gln Cys Tyr Met Asn Asp Thr
                500                 505                 510
Asn Ala Ser Glu Arg Glu Ala Val Glu His Val Lys Phe Leu Ile Arg
            515                 520                 525
Glu Ala Trp Lys Glu Met Asn Thr Val Thr Thr Ala Ser Asp Cys Pro
            530                 535                 540
Phe Thr Asp Asp Leu Val Ala Ala Ala Ala Asn Leu Ala Arg Ala Ala
545                 550                 555                 560
Gln Phe Ile Tyr Leu Asp Gly Asp Gly His Gly Val Gln His Ser Glu
                565                 570                 575
Ile His Gln Gln Met Gly Gly Leu Leu Phe Gln Pro Tyr Val
            580                 585                 590
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<210> 55
<211> 2861
<212> DNA
<213> Abies grandis

<220>
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<222> (3)...(2606)
<223> abietadiene synthase

<400> 55
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 ag atg gcc atg cct tcc tct tca ttg tca tca cag att ccc act gct        47
    Met Ala Met Pro Ser Ser Ser Leu Ser Ser Gln Ile Pro Thr Ala
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            1                5                        10                       15

gct cat cat cta act gct aac gca caa tcc att ccg cat ttc tcc acg          95
Ala His His Leu Thr Ala Asn Ala Gln Ser Ile Pro His Phe Ser Thr
                20                    25                    30

acg ctg aat gct gga agc agt gct agc aaa cgg aga agc ttg tac cta         143
Thr Leu Asn Ala Gly Ser Ser Ala Ser Lys Arg Arg Ser Leu Tyr Leu
            35                    40                    45

cga tgg ggt aaa ggt tca aac aag atc att gcc tgt gtt gga gaa ggt         191
Arg Trp Gly Lys Gly Ser Asn Lys Ile Ile Ala Cys Val Gly Glu Gly
            50                    55                    60

ggt gca acc tct gtt cct tat cag tct gct gaa aag aat gat tcg ctt         239
Gly Ala Thr Ser Val Pro Tyr Gln Ser Ala Glu Lys Asn Asp Ser Leu
        65                    70                    75

tct tct tct aca ttg gtg aaa cga gaa ttt cct cca gga ttt tgg aag         287
Ser Ser Ser Thr Leu Val Lys Arg Glu Phe Pro Pro Gly Phe Trp Lys
    80                    85                    90                    95

gat gat ctt atc gat tct cta acg tca tct cac aag gtt gca gca tca         335
Asp Asp Leu Ile Asp Ser Leu Thr Ser Ser His Lys Val Ala Ala Ser
                100                   105                   110

gac gag aag cgt atc gag aca tta ata tcc gag att aag aat atg ttt         383
Asp Glu Lys Arg Ile Glu Thr Leu Ile Ser Glu Ile Lys Asn Met Phe
            115                   120                   125

aga tgt atg ggc tat ggc gaa acg aat ccc tct gca tat gac act gct         431
Arg Cys Met Gly Tyr Gly Glu Thr Asn Pro Ser Ala Tyr Asp Thr Ala
            130                   135                   140

tgg gta gca agg att cca gca gtt gat ggc tct gac aac cct cac ttt         479
Trp Val Ala Arg Ile Pro Ala Val Asp Gly Ser Asp Asn Pro His Phe
            145                   150                   155

cct gag acg gtt gaa tgg att ctt caa aat cag ttg aaa gat ggg tct         527
Pro Glu Thr Val Glu Trp Ile Leu Gln Asn Gln Leu Lys Asp Gly Ser
160                   165                   170                   175

tgg ggt gaa gga ttc tac ttc ttg gca tat gac aga ata ctg gct aca         575
Trp Gly Glu Gly Phe Tyr Phe Leu Ala Tyr Asp Arg Ile Leu Ala Thr
                180                   185                   190

ctt gca tgt att att acc ctt acc ctc tgg cgt act ggg gag aca caa         623
Leu Ala Cys Ile Ile Thr Leu Thr Leu Trp Arg Thr Gly Glu Thr Gln
                195                   200                   205

gta cag aaa ggt att gaa ttc ttc agg aca caa gct gga aag atg gaa         671
Val Gln Lys Gly Ile Glu Phe Phe Arg Thr Gln Ala Gly Lys Met Glu
            210                   215                   220

gat gaa gct gat agt cat agg cca agt gga ttt gaa ata gta ttt cct         719
Asp Glu Ala Asp Ser His Arg Pro Ser Gly Phe Glu Ile Val Phe Pro
    225                   230                   235
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gca atg cta aag gaa gct aaa atc tta ggc ttg gat ctg cct tac gat      767
Ala Met Leu Lys Glu Ala Lys Ile Leu Gly Leu Asp Leu Pro Tyr Asp
240                 245                 250                 255

ttg cca ttc ctg aaa caa atc atc gaa aag cgg gag gct aag ctt aaa      815
Leu Pro Phe Leu Lys Gln Ile Ile Glu Lys Arg Glu Ala Lys Leu Lys
                260                 265                 270

agg att ccc act gat gtt ctc tat gcc ctt cca aca acg tta ttg tat      863
Arg Ile Pro Thr Asp Val Leu Tyr Ala Leu Pro Thr Thr Leu Leu Tyr
                275                 280                 285

tct ttg gaa ggt tta caa gaa ata gta gac tgg cag aaa ata atg aaa      911
Ser Leu Glu Gly Leu Gln Glu Ile Val Asp Trp Gln Lys Ile Met Lys
            290                 295                 300

ctt caa tcc aag gat gga tca ttt ctc agc tct ccg gca tct aca gcg      959
Leu Gln Ser Lys Asp Gly Ser Phe Leu Ser Ser Pro Ala Ser Thr Ala
        305                 310                 315

gct gta ttc atg cgt aca ggg aac aaa aag tgc ttg gat ttc ttg aac      1007
Ala Val Phe Met Arg Thr Gly Asn Lys Lys Cys Leu Asp Phe Leu Asn
320                 325                 330                 335

ttt gtc ttg aag aaa ttc gga aac cat gtg cct tgt cac tat ccg ctt      1055
Phe Val Leu Lys Lys Phe Gly Asn His Val Pro Cys His Tyr Pro Leu
                340                 345                 350

gat cta ttt gaa cgt ttg tgg gcg gtt gat aca gtt gag cgg cta ggt      1103
Asp Leu Phe Glu Arg Leu Trp Ala Val Asp Thr Val Glu Arg Leu Gly
            355                 360                 365

atc gat cgt cat ttc aaa gag gag atc aag gaa gca ttg gat tat gtt      1151
Ile Asp Arg His Phe Lys Glu Glu Ile Lys Glu Ala Leu Asp Tyr Val
            370                 375                 380

tac agc cat tgg gac gaa aga ggc att gga tgg gcg aga gag aat cct      1199
Tyr Ser His Trp Asp Glu Arg Gly Ile Gly Trp Ala Arg Glu Asn Pro
        385                 390                 395

gtt cct gat att gat gat aca gcc atg ggc ctt cga atc ttg aga tta      1247
Val Pro Asp Ile Asp Asp Thr Ala Met Gly Leu Arg Ile Leu Arg Leu
400                 405                 410                 415

cat gga tac aat gta tcc tca gat gtt tta aaa aca ttt aga gat gag      1295
His Gly Tyr Asn Val Ser Ser Asp Val Leu Lys Thr Phe Arg Asp Glu
                420                 425                 430

aat ggg gag ttc ttt tgc ttc ttg ggt caa aca cag aga gga gtt aca      1343
Asn Gly Glu Phe Phe Cys Phe Leu Gly Gln Thr Gln Arg Gly Val Thr
            435                 440                 445

gac atg tta aac gtc aat cgt tgt tca cat gtt tca ttt ccg gga gaa      1391
Asp Met Leu Asn Val Asn Arg Cys Ser His Val Ser Phe Pro Gly Glu
        450                 455                 460
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acg atc atg gaa gaa gca aaa ctc tgt acc gaa agg tat ctg agg aat      1439
Thr Ile Met Glu Glu Ala Lys Leu Cys Thr Glu Arg Tyr Leu Arg Asn
        465             470             475

gct ctg gaa aat gtg gat gcc ttt gac aaa tgg gct ttt aaa aag aat      1487
Ala Leu Glu Asn Val Asp Ala Phe Asp Lys Trp Ala Phe Lys Lys Asn
480             485             490                 495

att cgg gga gag gta gag tat gca ctc aaa tat ccc tgg cat aag agt      1535
Ile Arg Gly Glu Val Glu Tyr Ala Leu Lys Tyr Pro Trp His Lys Ser
                500             505             510

atg cca agg ttg gag gct aga agc tat att gaa aac tat ggg cca gat      1583
Met Pro Arg Leu Glu Ala Arg Ser Tyr Ile Glu Asn Tyr Gly Pro Asp
                515             520             525

gat gtg tgg ctt gga aaa act gta tat atg atg cca tac att tcg aat      1631
Asp Val Trp Leu Gly Lys Thr Val Tyr Met Met Pro Tyr Ile Ser Asn
                530             535             540

gaa aag tat tta gaa cta gcg aaa ctg gac ttc aat aag gtg cag tct      1679
Glu Lys Tyr Leu Glu Leu Ala Lys Leu Asp Phe Asn Lys Val Gln Ser
        545             550             555

ata cac caa aca gag ctt caa gat ctt cga agg tgg tgg aaa tca tcc      1727
Ile His Gln Thr Glu Leu Gln Asp Leu Arg Arg Trp Trp Lys Ser Ser
560             565             570                 575

ggt ttc acg gat ctg aat ttc act cgt gag cgt gtg acg gaa ata tat      1775
Gly Phe Thr Asp Leu Asn Phe Thr Arg Glu Arg Val Thr Glu Ile Tyr
                580             585             590

ttc tca ccg gca tcc ttt atc ttt gag ccc gag ttt tct aag tgc aga      1823
Phe Ser Pro Ala Ser Phe Ile Phe Glu Pro Glu Phe Ser Lys Cys Arg
                595             600             605

gag gtt tat aca aaa act tcc aat ttc act gtt att tta gat gat ctt      1871
Glu Val Tyr Thr Lys Thr Ser Asn Phe Thr Val Ile Leu Asp Asp Leu
                610             615             620

tat gac gcc cat gga tct tta gac gat ctt aag ttg ttc aca gaa tca      1919
Tyr Asp Ala His Gly Ser Leu Asp Asp Leu Lys Leu Phe Thr Glu Ser
                625             630             635

gtc aaa aga tgg gat cta tca cta gtg gac caa atg cca caa caa atg      1967
Val Lys Arg Trp Asp Leu Ser Leu Val Asp Gln Met Pro Gln Gln Met
640             645             650                 655

aaa ata tgt ttt gtg ggt ttc tac aat act ttt aat gat ata gca aaa      2015
Lys Ile Cys Phe Val Gly Phe Tyr Asn Thr Phe Asn Asp Ile Ala Lys
                660             665             670

gaa gga cgt gag agg caa ggg cgc gat gtg cta ggc tac att caa aat      2063
Glu Gly Arg Glu Arg Gln Gly Arg Asp Val Leu Gly Tyr Ile Gln Asn
                675             680             685

gtt tgg aaa gtc caa ctt gaa gct tac acg aaa gaa gca gaa tgg tct      2111
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```
Val Trp Lys Val Gln Leu Glu Ala Tyr Thr Lys Glu Ala Glu Trp Ser
        690             695                 700

gaa gct aaa tat gtg cca tcc ttc aat gaa tac ata gag aat gcg agt      2159
Glu Ala Lys Tyr Val Pro Ser Phe Asn Glu Tyr Ile Glu Asn Ala Ser
        705             710                 715

gtg tca ata gca ttg gga aca gtc gtt ctc att agt gct ctt ttc act      2207
Val Ser Ile Ala Leu Gly Thr Val Val Leu Ile Ser Ala Leu Phe Thr
720             725                 730                 735

ggg gag gtt ctt aca gat gaa gta ctc tcc aaa att gat cgc gaa tct      2255
Gly Glu Val Leu Thr Asp Glu Val Leu Ser Lys Ile Asp Arg Glu Ser
                740                 745                 750

aga ttt ctt caa ctc atg ggc tta aca ggg cgt ttg gtg aat gac acc      2303
Arg Phe Leu Gln Leu Met Gly Leu Thr Gly Arg Leu Val Asn Asp Thr
            755                 760                 765

aaa act tat cag gca gag aga ggt caa ggt gag gtg gct tct gcc ata      2351
Lys Thr Tyr Gln Ala Glu Arg Gly Gln Gly Glu Val Ala Ser Ala Ile
            770                 775                 780

caa tgt tat atg aag gac cat cct aaa atc tct gaa gaa gaa gct cta      2399
Gln Cys Tyr Met Lys Asp His Pro Lys Ile Ser Glu Glu Glu Ala Leu
785             790                 795

caa cat gtc tat agt gtc atg gaa aat gcc ctc gaa gag ttg aat agg      2447
Gln His Val Tyr Ser Val Met Glu Asn Ala Leu Glu Glu Leu Asn Arg
800             805                 810                 815

gag ttt gtg aat aac aaa ata ccg gat att tac aaa aga ctg gtt ttt      2495
Glu Phe Val Asn Asn Lys Ile Pro Asp Ile Tyr Lys Arg Leu Val Phe
                820                 825                 830

gaa act gca aga ata atg caa ctc ttt tat atg caa ggg gat ggt ttg      2543
Glu Thr Ala Arg Ile Met Gln Leu Phe Tyr Met Gln Gly Asp Gly Leu
                835                 840                 845

aca cta tca cat gat atg gaa att aaa gag cat gtc aaa aat tgc ctc      2591
Thr Leu Ser His Asp Met Glu Ile Lys Glu His Val Lys Asn Cys Leu
            850                 855                 860

ttc caa cca gtt gcc tag attaaattat tcagttaaag gccctcatgg            2639
Phe Gln Pro Val Ala
            865


tattgtgtta acattataat aacagatgct caaaagcttt gagcggtatt tgttaaggct   2699
atctttgttt gtttgtttgt ttactgccaa ccaaaaagcg ttcctaaacc tttgaagaca   2759
tttccatcca agagatggag tctacatttt atttatgaga ttgaattatt tcaagagaat   2819
atactacata tatttaaaag taaaaaaaaa aaaaaaaaaa aa                      2861

<210> 56
<211> 868
<212> PRT
<213> Abies grandis
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<400> 56

Met Ala Met Pro Ser Ser Ser Leu Ser Ser Gln Ile Pro Thr Ala Ala
1   5   10   15
His His Leu Thr Ala Asn Ala Gln Ser Ile Pro His Phe Ser Thr Thr
            20   25   30
Leu Asn Ala Gly Ser Ser Ala Ser Lys Arg Arg Ser Leu Tyr Leu Arg
        35   40   45
Trp Gly Lys Gly Ser Asn Lys Ile Ile Ala Cys Val Gly Glu Gly Gly
    50   55   60
Ala Thr Ser Val Pro Tyr Gln Ser Ala Glu Lys Asn Asp Ser Leu Ser
65   70   75   80
Ser Ser Thr Leu Val Lys Arg Glu Phe Pro Pro Gly Phe Trp Lys Asp
                85   90   95
Asp Leu Ile Asp Ser Leu Thr Ser Ser His Lys Val Ala Ala Ser Asp
            100   105   110
Glu Lys Arg Ile Glu Thr Leu Ile Ser Glu Ile Lys Asn Met Phe Arg
        115   120   125
Cys Met Gly Tyr Gly Glu Thr Asn Pro Ser Ala Tyr Asp Thr Ala Trp
    130   135   140
Val Ala Arg Ile Pro Ala Val Asp Gly Ser Asp Asn Pro His Phe Pro
145   150   155   160
Glu Thr Val Glu Trp Ile Leu Gln Asn Gln Leu Lys Asp Gly Ser Trp
                165   170   175
Gly Glu Gly Phe Tyr Phe Leu Ala Tyr Asp Arg Ile Leu Ala Thr Leu
            180   185   190
Ala Cys Ile Ile Thr Leu Thr Leu Trp Arg Thr Gly Glu Thr Gln Val
            195   200   205
Gln Lys Gly Ile Glu Phe Phe Arg Thr Gln Ala Gly Lys Met Glu Asp
    210   215   220
Glu Ala Asp Ser His Arg Pro Ser Gly Phe Glu Ile Val Phe Pro Ala
225   230   235   240
Met Leu Lys Glu Ala Lys Ile Leu Gly Leu Asp Leu Pro Tyr Asp Leu
                245   250   255
Pro Phe Leu Lys Gln Ile Ile Glu Lys Arg Glu Ala Lys Leu Lys Arg
            260   265   270
Ile Pro Thr Asp Val Leu Tyr Ala Leu Pro Thr Thr Leu Leu Tyr Ser
            275   280   285
Leu Glu Gly Leu Gln Glu Ile Val Asp Trp Gln Lys Ile Met Lys Leu
    290   295   300
Gln Ser Lys Asp Gly Ser Phe Leu Ser Ser Pro Ala Ser Thr Ala Ala
305   310   315   320
Val Phe Met Arg Thr Gly Asn Lys Lys Cys Leu Asp Phe Leu Asn Phe
            325   330   335
Val Leu Lys Lys Phe Gly Asn His Val Pro Cys His Tyr Pro Leu Asp
            340   345   350
Leu Phe Glu Arg Leu Trp Ala Val Asp Thr Val Glu Arg Leu Gly Ile
    355   360   365
Asp Arg His Phe Lys Glu Glu Ile Lys Glu Ala Leu Asp Tyr Val Tyr
    370   375   380
Ser His Trp Asp Glu Arg Gly Ile Gly Trp Ala Arg Glu Asn Pro Val
385   390   395   400
Pro Asp Ile Asp Asp Thr Ala Met Gly Leu Arg Ile Leu Arg Leu His
            405   410   415
Gly Tyr Asn Val Ser Ser Asp Val Leu Lys Thr Phe Arg Asp Glu Asn
            420   425   430
Gly Glu Phe Phe Cys Phe Leu Gly Gln Thr Gln Arg Gly Val Thr Asp
    435   440   445

```
Met Leu Asn Val Asn Arg Cys Ser His Val Ser Phe Pro Gly Glu Thr
    450                 455             460
Ile Met Glu Glu Ala Lys Leu Cys Thr Glu Arg Tyr Leu Arg Asn Ala
465             470                 475                     480
Leu Glu Asn Val Asp Ala Phe Asp Lys Trp Ala Phe Lys Lys Asn Ile
                485                 490                 495
Arg Gly Glu Val Glu Tyr Ala Leu Lys Tyr Pro Trp His Lys Ser Met
                500                 505             510
Pro Arg Leu Glu Ala Arg Ser Tyr Ile Glu Asn Tyr Gly Pro Asp Asp
            515                 520             525
Val Trp Leu Gly Lys Thr Val Tyr Met Met Pro Tyr Ile Ser Asn Glu
    530                 535             540
Lys Tyr Leu Glu Leu Ala Lys Leu Asp Phe Asn Lys Val Gln Ser Ile
545             550                 555                     560
His Gln Thr Glu Leu Gln Asp Leu Arg Arg Trp Trp Lys Ser Ser Gly
                565                 570                 575
Phe Thr Asp Leu Asn Phe Thr Arg Glu Arg Val Thr Glu Ile Tyr Phe
            580                 585             590
Ser Pro Ala Ser Phe Ile Phe Glu Pro Glu Phe Ser Lys Cys Arg Glu
        595                 600                 605
Val Tyr Thr Lys Thr Ser Asn Phe Thr Val Ile Leu Asp Asp Leu Tyr
    610                 615                 620
Asp Ala His Gly Ser Leu Asp Asp Leu Lys Leu Phe Thr Glu Ser Val
625                 630                 635                     640
Lys Arg Trp Asp Leu Ser Leu Val Asp Gln Met Pro Gln Gln Met Lys
                645                 650                 655
Ile Cys Phe Val Gly Phe Tyr Asn Thr Phe Asn Asp Ile Ala Lys Glu
            660                 665             670
Gly Arg Glu Arg Gln Gly Arg Asp Val Leu Gly Tyr Ile Gln Asn Val
        675                 680                 685
Trp Lys Val Gln Leu Glu Ala Tyr Thr Lys Glu Ala Glu Trp Ser Glu
    690                 695             700
Ala Lys Tyr Val Pro Ser Phe Asn Glu Tyr Ile Glu Asn Ala Ser Val
705                 710                 715                     720
Ser Ile Ala Leu Gly Thr Val Val Leu Ile Ser Ala Leu Phe Thr Gly
                725                 730                 735
Glu Val Leu Thr Asp Glu Val Leu Ser Lys Ile Asp Arg Glu Ser Arg
            740                 745             750
Phe Leu Gln Leu Met Gly Leu Thr Gly Arg Leu Val Asn Asp Thr Lys
        755                 760                 765
Thr Tyr Gln Ala Glu Arg Gly Gln Gly Glu Val Ala Ser Ala Ile Gln
    770                 775             780
Cys Tyr Met Lys Asp His Pro Lys Ile Ser Glu Glu Glu Ala Leu Gln
785             790                 795                     800
His Val Tyr Ser Val Met Glu Asn Ala Leu Glu Glu Leu Asn Arg Glu
                805                 810                 815
Phe Val Asn Asn Lys Ile Pro Asp Ile Tyr Lys Arg Leu Val Phe Glu
                820                 825             830
Thr Ala Arg Ile Met Gln Leu Phe Tyr Met Gln Gly Asp Gly Leu Thr
        835                 840                 845
Leu Ser His Asp Met Glu Ile Lys Glu His Val Lys Asn Cys Leu Phe
    850                 855                 860
Gln Pro Val Ala
865
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<210> 57
<211> 2089

<212> DNA
<213> Abies grandis

<220>
<221> CDS
<222> (73)...(1983)
<223> (-)-4S-limonene synthase

<400> 57
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aggcaggaat cc atg gct ctc ctt tct atc gta tct ttg cag gtt ccc aaa      111
            Met Ala Leu Leu Ser Ile Val Ser Leu Gln Val Pro Lys
            1               5                   10

tcc tgc ggg ctg aaa tcg ttg atc agt tcc agc aat gtg cag aag gct      159
Ser Cys Gly Leu Lys Ser Leu Ile Ser Ser Ser Asn Val Gln Lys Ala
    15              20                  25

ctc tgt atc tct aca gca gtc cca aca ctc aga atg cgt agg cga cag      207
Leu Cys Ile Ser Thr Ala Val Pro Thr Leu Arg Met Arg Arg Arg Gln
30              35                  40                  45

aaa gct ctg gtc atc aac atg aaa ttg acc act gta tcc cat cgt gat      255
Lys Ala Leu Val Ile Asn Met Lys Leu Thr Thr Val Ser His Arg Asp
                50                  55                  60

gat aat ggt ggt ggt gta ctg caa aga cgc ata gcc gat cat cat ccc      303
Asp Asn Gly Gly Gly Val Leu Gln Arg Arg Ile Ala Asp His His Pro
            65                  70                  75

aac ctg tgg gaa gat gat ttc ata caa tca ttg tcc tca cct tat ggg      351
Asn Leu Trp Glu Asp Asp Phe Ile Gln Ser Leu Ser Ser Pro Tyr Gly
        80                  85                  90

gga tct tcg tac agt gaa cgt gct gag aca gtc gtt gag gaa gta aaa      399
Gly Ser Ser Tyr Ser Glu Arg Ala Glu Thr Val Val Glu Glu Val Lys
    95                  100                 105

gag atg ttc aat tca ata cca aat aat aga gaa tta ttt ggt tcc caa      447
Glu Met Phe Asn Ser Ile Pro Asn Asn Arg Glu Leu Phe Gly Ser Gln
110                 115                 120                 125

aat gat ctc ctt aca cgc ctt tgg atg gtg gat agc att gaa cgt ctg      495
Asn Asp Leu Leu Thr Arg Leu Trp Met Val Asp Ser Ile Glu Arg Leu
                130                 135                 140

ggg ata gat aga cat ttc caa aat gag ata aga gta gcc ctc gat tat      543
Gly Ile Asp Arg His Phe Gln Asn Glu Ile Arg Val Ala Leu Asp Tyr
                145                 150                 155

gtt tac agt tat tgg aag gaa aag gaa ggc att ggg tgt ggc aga gat      591
Val Tyr Ser Tyr Trp Lys Glu Lys Glu Gly Ile Gly Cys Gly Arg Asp
        160                 165                 170

tct act ttt cct gat ctc aac tcg act gcc ttg gcg ctt cga act ctt      639
Ser Thr Phe Pro Asp Leu Asn Ser Thr Ala Leu Ala Leu Arg Thr Leu
    175                 180                 185
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cga ctg cac gga tac aat gtg tct tca gat gtg ctg gaa tac ttc aaa       687
Arg Leu His Gly Tyr Asn Val Ser Ser Asp Val Leu Glu Tyr Phe Lys
190             195             200             205

gat gaa aag ggg cat ttt gcc tgc cct gca atc cta acc gag gga cag       735
Asp Glu Lys Gly His Phe Ala Cys Pro Ala Ile Leu Thr Glu Gly Gln
            210             215             220

atc act aga agt gtt cta aat tta tat cgg gct tcc ctg gtc gcc ttt       783
Ile Thr Arg Ser Val Leu Asn Leu Tyr Arg Ala Ser Leu Val Ala Phe
            225             230             235

ccc ggg gag aaa gtt atg gaa gag gct gaa atc ttc tcg gca tct tat       831
Pro Gly Glu Lys Val Met Glu Glu Ala Glu Ile Phe Ser Ala Ser Tyr
        240             245             250

ttg aaa aaa gtc tta caa aag att ccg gtc tcc aat ctt tca gga gag       879
Leu Lys Lys Val Leu Gln Lys Ile Pro Val Ser Asn Leu Ser Gly Glu
    255             260             265

ata gaa tat gtt ttg gaa tat ggt tgg cac acg aat ttg ccg aga ttg       927
Ile Glu Tyr Val Leu Glu Tyr Gly Trp His Thr Asn Leu Pro Arg Leu
270             275             280             285

gaa gca aga aat tat atc gag gtc tac gag cag agc ggc tat gaa agc       975
Glu Ala Arg Asn Tyr Ile Glu Val Tyr Glu Gln Ser Gly Tyr Glu Ser
            290             295             300

tta aac gag atg cca tat atg aac atg aag aag ctt tta caa ctt gca      1023
Leu Asn Glu Met Pro Tyr Met Asn Met Lys Lys Leu Leu Gln Leu Ala
            305             310             315

aaa ttg gag ttc aat atc ttt cac tct ttg caa cta aga gag tta caa      1071
Lys Leu Glu Phe Asn Ile Phe His Ser Leu Gln Leu Arg Glu Leu Gln
        320             325             330

tct atc tcc aga tgg tgg aaa gaa tca ggt tcg tct caa ctg act ttt      1119
Ser Ile Ser Arg Trp Trp Lys Glu Ser Gly Ser Ser Gln Leu Thr Phe
        335             340             345

aca cgg cat cgt cac gtg gaa tac tac act atg gca tct tgc att tct      1167
Thr Arg His Arg His Val Glu Tyr Tyr Thr Met Ala Ser Cys Ile Ser
350             355             360             365

atg ttg cca aaa cat tca gct ttc aga atg gag ttt gtc aaa gtg tgt      1215
Met Leu Pro Lys His Ser Ala Phe Arg Met Glu Phe Val Lys Val Cys
            370             375             380

cat ctt gta aca gtt ctc gat gat ata tat gac act ttt gga aca atg      1263
His Leu Val Thr Val Leu Asp Asp Ile Tyr Asp Thr Phe Gly Thr Met
            385             390             395

aac gaa ctc caa ctt ttt acg gat gca att aag aga tgg gat ttg tca      1311
Asn Glu Leu Gln Leu Phe Thr Asp Ala Ile Lys Arg Trp Asp Leu Ser
        400             405             410
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acg aca agg tgg ctt cca gaa tat atg aaa gga gtg tac atg gac ttg        1359
Thr Thr Arg Trp Leu Pro Glu Tyr Met Lys Gly Val Tyr Met Asp Leu
    415                 420                 425

tat caa tgc att aat gaa atg gtg gaa gag gct gag aag act caa ggc        1407
Tyr Gln Cys Ile Asn Glu Met Val Glu Glu Ala Glu Lys Thr Gln Gly
430                 435                 440                 445

cga gat atg ctc aac tat att caa aat gct tgg gaa gcc cta ttt gat        1455
Arg Asp Met Leu Asn Tyr Ile Gln Asn Ala Trp Glu Ala Leu Phe Asp
                450                 455                 460

acc ttt atg caa gaa gca aag tgg atc tcc agc agt tat ctc cca acg        1503
Thr Phe Met Gln Glu Ala Lys Trp Ile Ser Ser Ser Tyr Leu Pro Thr
                465                 470                 475

ttt gag gag tac ttg aag aat gca aaa gtt agt tct ggt tct cgc ata        1551
Phe Glu Glu Tyr Leu Lys Asn Ala Lys Val Ser Ser Gly Ser Arg Ile
            480                 485                 490

gcc aca tta caa ccc att ctc act ttg gat gta cca ctt cct gat tac        1599
Ala Thr Leu Gln Pro Ile Leu Thr Leu Asp Val Pro Leu Pro Asp Tyr
    495                 500                 505

ata ctg caa gaa att gat tat cca tcc aga ttc aat gag tta gct tcg        1647
Ile Leu Gln Glu Ile Asp Tyr Pro Ser Arg Phe Asn Glu Leu Ala Ser
510                 515                 520                 525

tcc atc ctt cga cta cga ggt gac acg cgc tgc tac aag gcg gat agg        1695
Ser Ile Leu Arg Leu Arg Gly Asp Thr Arg Cys Tyr Lys Ala Asp Arg
                530                 535                 540

gcc cgt gga gaa gaa gct tca gct ata tcg tgt tat atg aaa gac cat        1743
Ala Arg Gly Glu Glu Ala Ser Ala Ile Ser Cys Tyr Met Lys Asp His
                545                 550                 555

cct gga tca ata gag gaa gat gct ctc aat cat atc aac gcc atg atc        1791
Pro Gly Ser Ile Glu Glu Asp Ala Leu Asn His Ile Asn Ala Met Ile
                560                 565                 570

agt gat gca atc aga gaa tta aat tgg gag ctt ctc aga ccg gat agc        1839
Ser Asp Ala Ile Arg Glu Leu Asn Trp Glu Leu Leu Arg Pro Asp Ser
    575                 580                 585

aaa agt ccc atc tct tcc aag aaa cat gct ttt gac atc acc aga gct        1887
Lys Ser Pro Ile Ser Ser Lys Lys His Ala Phe Asp Ile Thr Arg Ala
590                 595                 600                 605

ttc cat cat gtc tac aaa tat cga gat ggt tac act gtt tcc aac aac        1935
Phe His His Val Tyr Lys Tyr Arg Asp Gly Tyr Thr Val Ser Asn Asn
                610                 615                 620

gaa aca aag aat ttg gtg atg aaa acc gtt ctt gaa cct ctc gct ttg        1983
Glu Thr Lys Asn Leu Val Met Lys Thr Val Leu Glu Pro Leu Ala Leu
                625                 630                 635

taa aaacatatag aatgcattaa aatgtgggaa gtctataatc tagactattc            2036
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tctatctttc ataatgtaga tctggatgtg tattgaactc taaaaaaaaa aaa   2089

<210> 58
<211> 637
<212> PRT
<213> Abies grandis

<400> 58

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Leu Lys Ser Leu Ile Ser Ser Ser Asn Val Gln Lys Ala Leu Cys Ile
                20                  25                  30
Ser Thr Ala Val Pro Thr Leu Arg Met Arg Arg Arg Gln Lys Ala Leu
            35                  40                  45
Val Ile Asn Met Lys Leu Thr Thr Val Ser His Arg Asp Asp Asn Gly
        50                  55                  60
Gly Gly Val Leu Gln Arg Arg Ile Ala Asp His His Pro Asn Leu Trp
65                  70                  75                  80
Glu Asp Asp Phe Ile Gln Ser Leu Ser Ser Pro Tyr Gly Gly Ser Ser
                85                  90                  95
Tyr Ser Glu Arg Ala Glu Thr Val Val Glu Glu Val Lys Glu Met Phe
            100                 105                 110
Asn Ser Ile Pro Asn Asn Arg Glu Leu Phe Gly Ser Gln Asn Asp Leu
        115                 120                 125
Leu Thr Arg Leu Trp Met Val Asp Ser Ile Glu Arg Leu Gly Ile Asp
    130                 135                 140
Arg His Phe Gln Asn Glu Ile Arg Val Ala Leu Asp Tyr Val Tyr Ser
145                 150                 155                 160
Tyr Trp Lys Glu Lys Glu Gly Ile Gly Cys Gly Arg Asp Ser Thr Phe
                165                 170                 175
Pro Asp Leu Asn Ser Thr Ala Leu Ala Leu Arg Thr Leu Arg Leu His
            180                 185                 190
Gly Tyr Asn Val Ser Ser Asp Val Leu Glu Tyr Phe Lys Asp Glu Lys
        195                 200                 205
Gly His Phe Ala Cys Pro Ala Ile Leu Thr Glu Gly Gln Ile Thr Arg
    210                 215                 220
Ser Val Leu Asn Leu Tyr Arg Ala Ser Leu Val Ala Phe Pro Gly Glu
225                 230                 235                 240
Lys Val Met Glu Glu Ala Glu Ile Phe Ser Ala Ser Tyr Leu Lys Lys
                245                 250                 255
Val Leu Gln Lys Ile Pro Val Ser Asn Leu Ser Gly Glu Ile Glu Tyr
            260                 265                 270
Val Leu Glu Tyr Gly Trp His Thr Asn Leu Pro Arg Leu Glu Ala Arg
        275                 280                 285
Asn Tyr Ile Glu Val Tyr Glu Gln Ser Gly Tyr Glu Ser Leu Asn Glu
        290                 295                 300
Met Pro Tyr Met Asn Met Lys Lys Leu Leu Gln Leu Ala Lys Leu Glu
305                 310                 315                 320
Phe Asn Ile Phe His Ser Leu Gln Leu Arg Glu Leu Gln Ser Ile Ser
                325                 330                 335
Arg Trp Trp Lys Glu Ser Gly Ser Ser Gln Leu Thr Phe Thr Arg His
            340                 345                 350
Arg His Val Glu Tyr Tyr Thr Met Ala Ser Cys Ile Ser Met Leu Pro
        355                 360                 365
Lys His Ser Ala Phe Arg Met Glu Phe Val Lys Val Cys His Leu Val
370                 375                 380
Thr Val Leu Asp Asp Ile Tyr Asp Thr Phe Gly Thr Met Asn Glu Leu
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385                    390                      395                         400
Gln Leu Phe Thr Asp Ala Ile Lys Arg Trp Asp Leu Ser Thr Thr Arg
                405                      410                  415
Trp Leu Pro Glu Tyr Met Lys Gly Val Tyr Met Asp Leu Tyr Gln Cys
            420                      425                  430
Ile Asn Glu Met Val Glu Glu Ala Glu Lys Thr Gln Gly Arg Asp Met
        435                      440                  445
Leu Asn Tyr Ile Gln Asn Ala Trp Glu Ala Leu Phe Asp Thr Phe Met
    450                      455                  460
Gln Glu Ala Lys Trp Ile Ser Ser Ser Tyr Leu Pro Thr Phe Glu Glu
465                      470                  475                  480
Tyr Leu Lys Asn Ala Lys Val Ser Ser Gly Ser Arg Ile Ala Thr Leu
                485                      490                  495
Gln Pro Ile Leu Thr Leu Asp Val Pro Leu Pro Asp Tyr Ile Leu Gln
            500                      505                  510
Glu Ile Asp Tyr Pro Ser Arg Phe Asn Glu Leu Ala Ser Ser Ile Leu
            515                      520                  525
Arg Leu Arg Gly Asp Thr Arg Cys Tyr Lys Ala Asp Arg Ala Arg Gly
    530                      535                  540
Glu Glu Ala Ser Ala Ile Ser Cys Tyr Met Lys Asp His Pro Gly Ser
545                      550                  555                  560
Ile Glu Glu Asp Ala Leu Asn His Ile Asn Ala Met Ile Ser Asp Ala
                565                      570                  575
Ile Arg Glu Leu Asn Trp Glu Leu Leu Arg Pro Asp Ser Lys Ser Pro
            580                      585                  590
Ile Ser Ser Lys Lys His Ala Phe Asp Ile Thr Arg Ala Phe His His
            595                      600                  605
Val Tyr Lys Tyr Arg Asp Gly Tyr Thr Val Ser Asn Asn Glu Thr Lys
    610                      615                  620
Asn Leu Val Met Lys Thr Val Leu Glu Pro Leu Ala Leu
625                      630                  635
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